[O] -Rd:2

Composer / Researcher:

Dimitri Voudouris

Annum:

2008 – 2010

Duration:

13 min 06 sec

Composition:

[O] -Rd:2

to:

Petra Ronner

Calculating elastic behaviour of complex microscopic systems:
Examining uni-directional vehicular motion

for:

Piano

and

Digital Audio Tape

[5.1 Speaker Diffusion system]

Petra Ronner

Pianist

Petra Ronner was born in Zürich. She studied with pianist Werner Bärtschi. Extended teaching and playing activities, mainly with contemporary vocal and instrumental chamber music "Composed concert programs" with English countertenor Christopher Robson for various international festivals Solo performances, among others "Sonatas and Interludes for prepared piano" by John Cage. She performed numerous commissioned works from Swiss and German composers. She contributed sound conception-work for many theatre performances and did sound installation in various context. From 1996 to 1999 she participated the contemporary music concert organisation group at Rote Fabrik Zürich and is running her own offshoot- concert venue.

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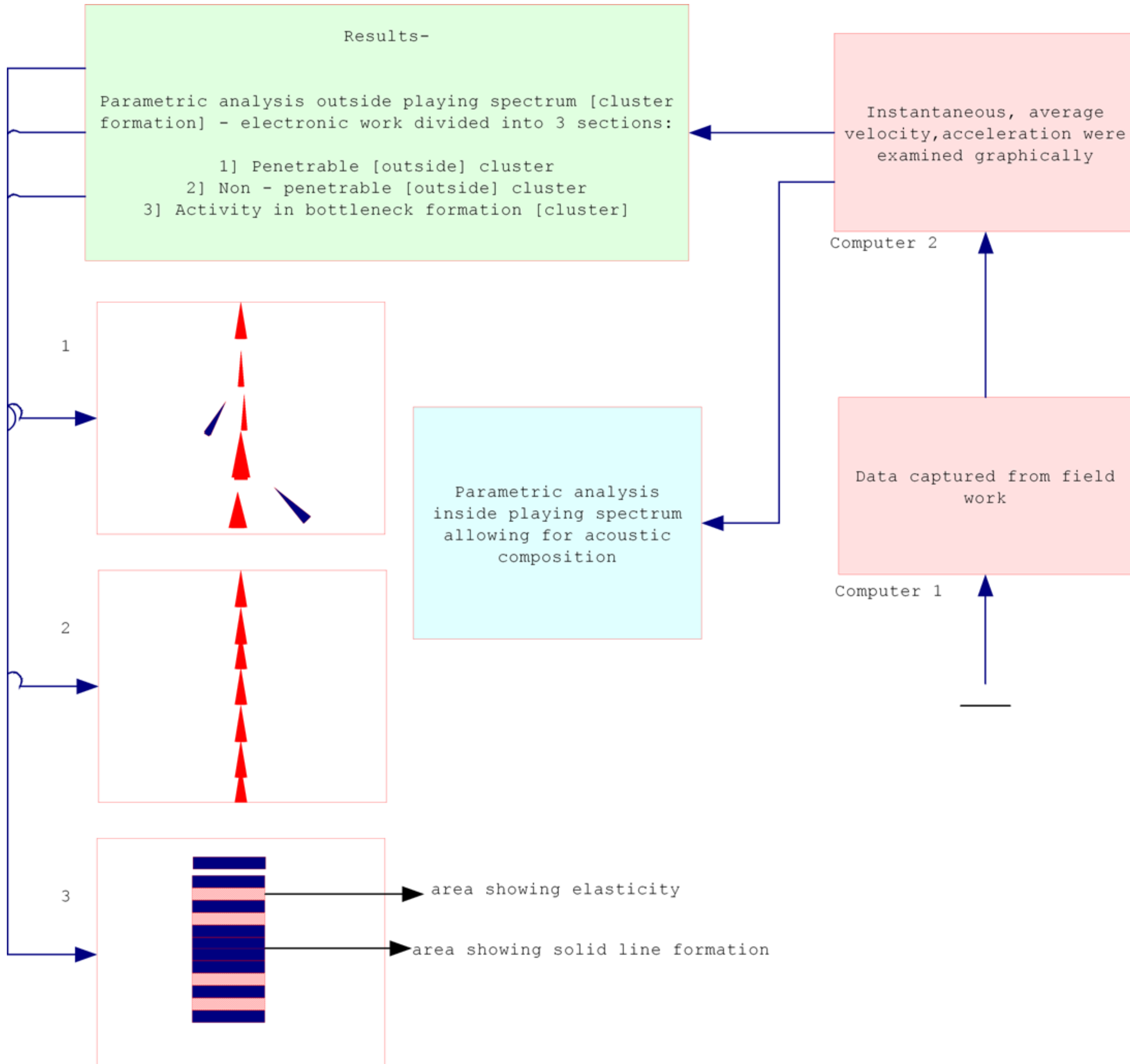


Diagrammatic - work layout

Synopsis in the creation:

[O]-Rd:2

A site-specific project that investigates the elastic potential energies exhibited by [uni-directional] vehicular motion in cluster formations. This was conducted by alterations in speed approaching a bottleneck formation. Numerous data was captured on Ontdekkers road in Roodepoort, of traffic mobility. The behaviour of traffic mobility was studied as moving from three lanes into a single lane in peak hour from 7h00 to 8h30 29th October 2009 – 5th January 2010 on a straight plane that had an incline of 55°.

To attain identifiable specifications in particular cluster formations, vehicles had to be grouped in various categories of mass, volume, speed, classification data.

Usage of **cameras** - to observe velocity and to study traffic behaviour and the usage of the **ARRB Express-Weigh WIM system** that integrates LINEAS quartz sensors into the ARRB WIM/traffic data logger to collect accurate vehicle volume, speed, classification and axle mass data.

Determining the linear momentum of the various groups of vehicles [a product of mass and velocity] which are frame dependant [a person driving a vehicle] and are subjected to various forces i.e. stop and start, acceleration and deceleration in speed -showed elastic property behaviours in cluster and just prior to cluster formation. Attention was placed in particular to the elastic mobility of vehicles. **Matlab** allowed for the translation of the data collected from the analysis into audio frequency parameter evaluation as well as time duration relationships for each occurring event.

The sound generated on the digital audio tape as well as the acoustic source [the piano] is of equal importance and is governed by the kinetic mobility theory, with exponents dominated solely by external characteristics of the intrinsic velocity distribution behaviours. The elastic properties generated by these cluster formations flowing from three lanes into a single lane were particularly noticeable and were scored into the peace as electronic sounds [outside the playing spectrum] and acoustic sounds [inside the playing spectrum] this resulted in dynamic changes of performance at particular points in the score. Direct relationships between the flow of clusters that are directly related to density formations were associated to audio frequency variations and velocity variations to time duration relationships.

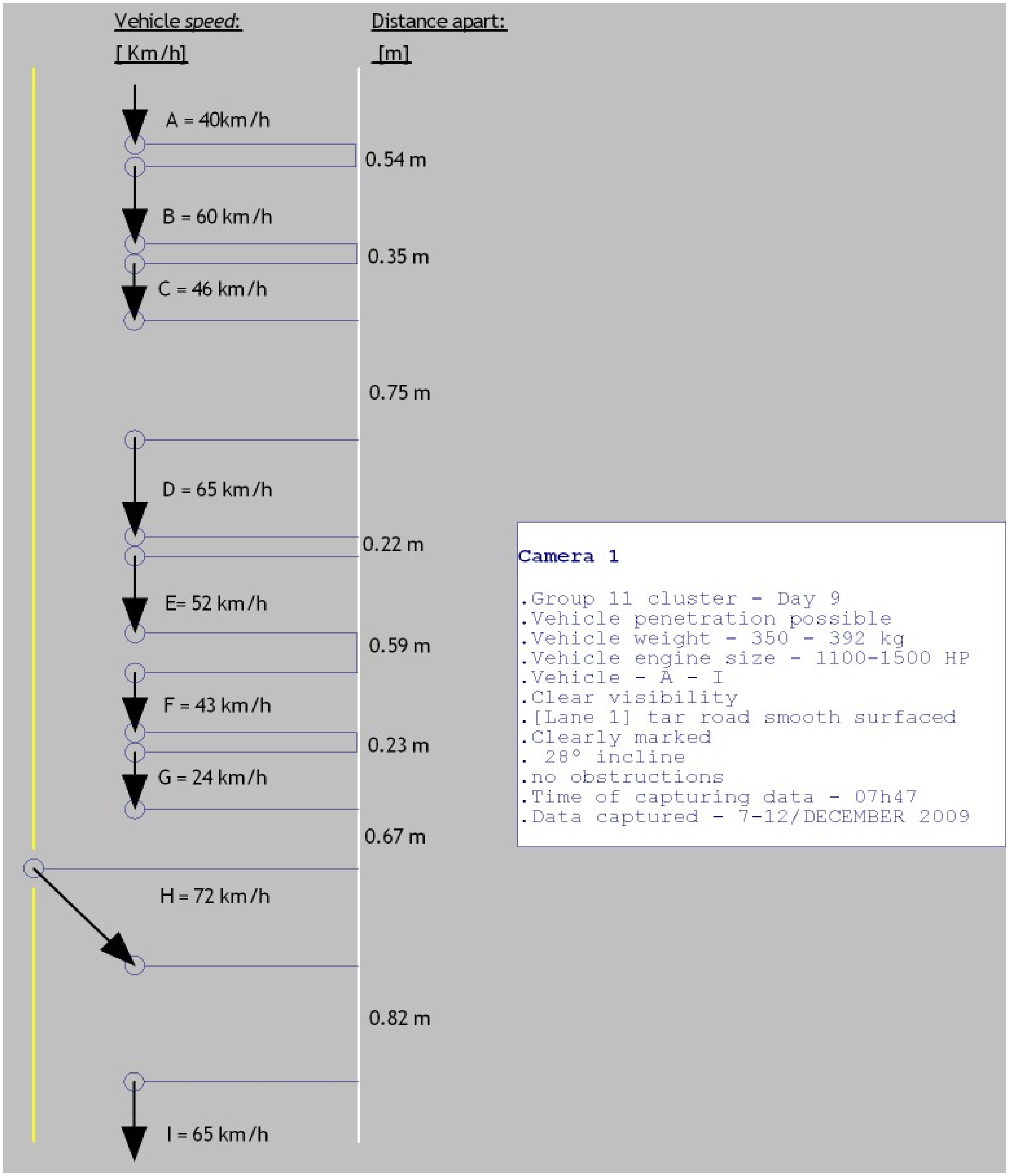


Diagram 1:

Camera 1 - Variations in vehicle
velocity showing elastic potential energy formations
[expansion and contraction] in Group 11- Bar 76 and 77

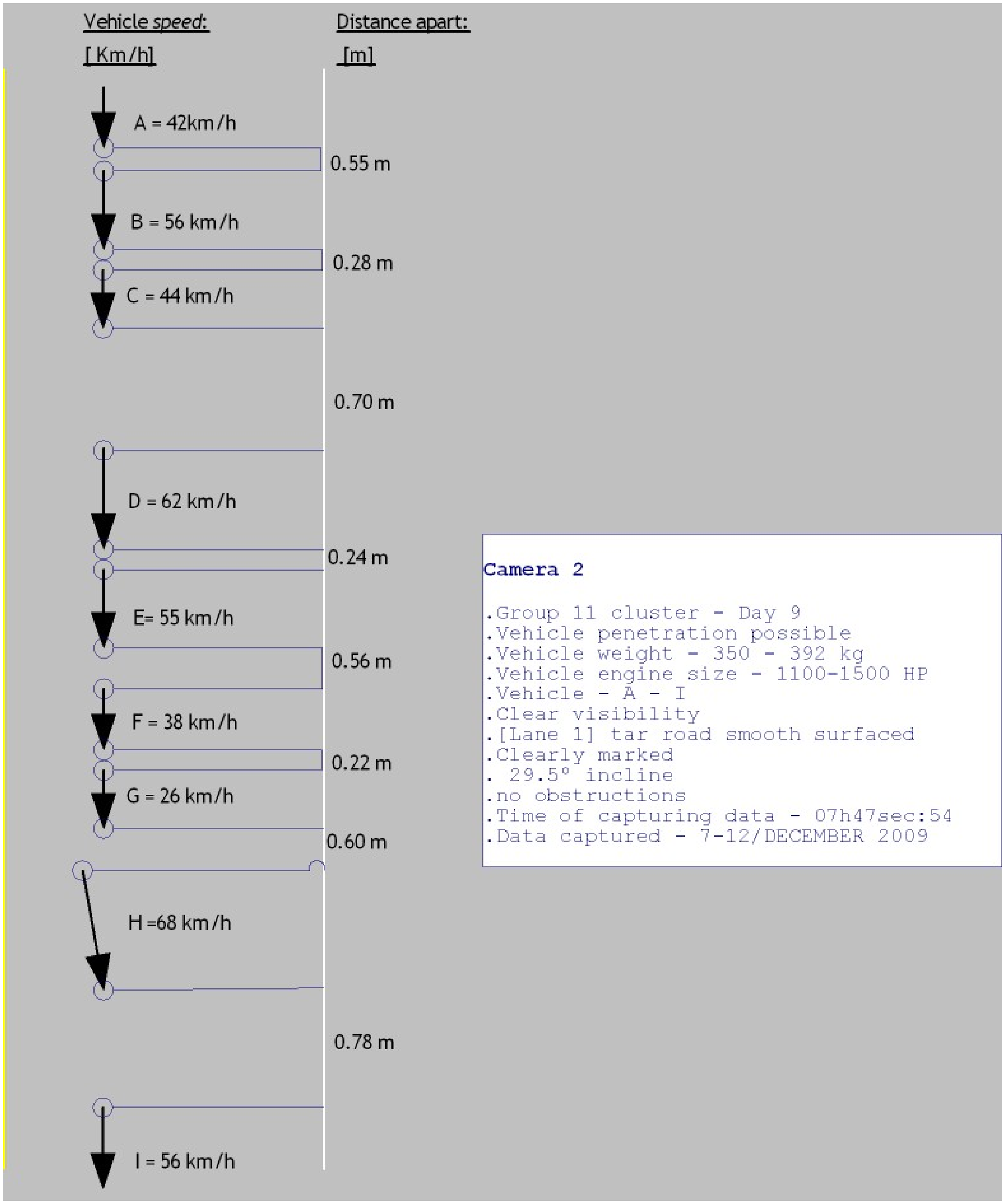


Diagram 2:

Camera 2 - Variations in vehicle velocity showing elastic potential energy formations [expansion and contraction] in Group 11- Bar 76 and 77

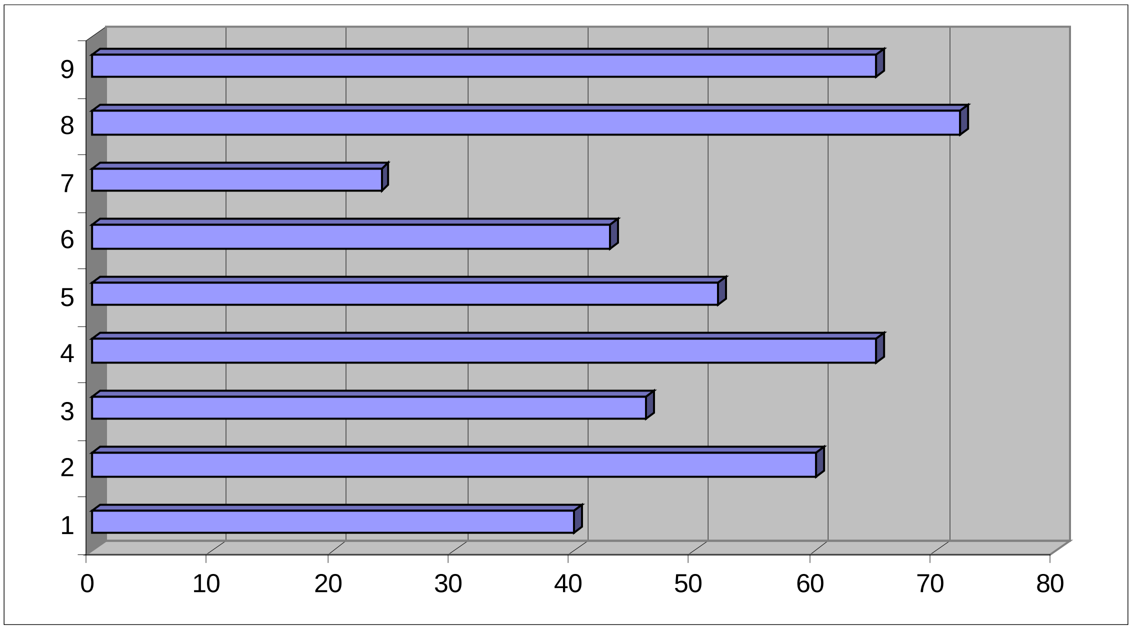
Diagram 3

Score showing Group 11 in a light vehicle moving cluster
which allows for outside vehicle penetration at bar 76-77

There were also areas in the score between bars 44-49, 61-63, 208-218, 227 – 229 which showed alternate vehicle motion and thus a second score [score 2] was mathematically formulated so that the pianist could choose by playing one of the two scores or play both simultaneously. These occurrences were mainly variations in vehicle behaviour [of a specific time of day] that had to be formulated to make the investigation complete.

Relationship between acoustic sounds and the electronic sound component:

I mentioned earlier that sounds of particular frequencies did not match the playing spectrum of the piano thus they were converted to fixed electronic sounds [time versus dynamics, pitch, frequency] using sounds that would conform to the frequency specifications directly relating to the outcome results, the sounds that did conform to the piano frequencies were carefully selected and notated. Graphic plotting the data allowed for the examination of each cluster generation and that intern generated particular sound possibilities [of varying frequencies], the results were accurately placed at particular positions/points on the tape.



Km/h

Diagram 4 : ***Camera 1*:** Graphic representation of Group 11 cluster
[noted: varied velocities *Bar 76-77*]

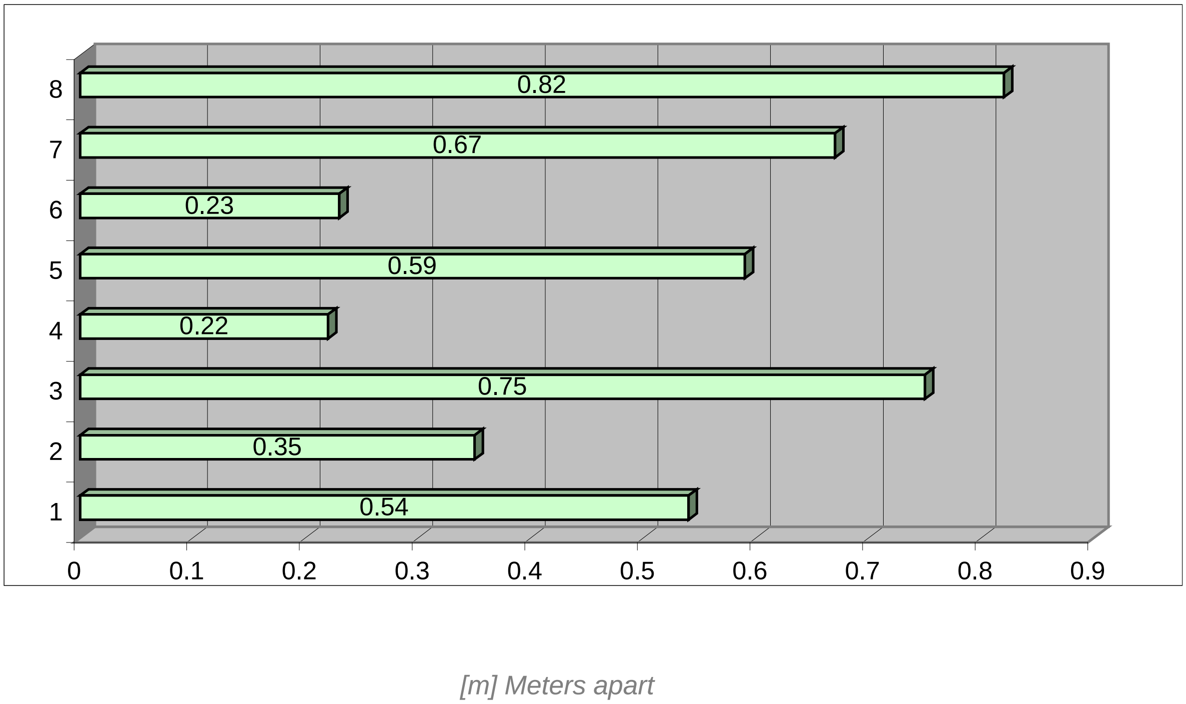


Diagram 5 : ***Camera 1:*** Graphic representation of Group 11 cluster
[noted: varied distances apart *Bar 76-77*]

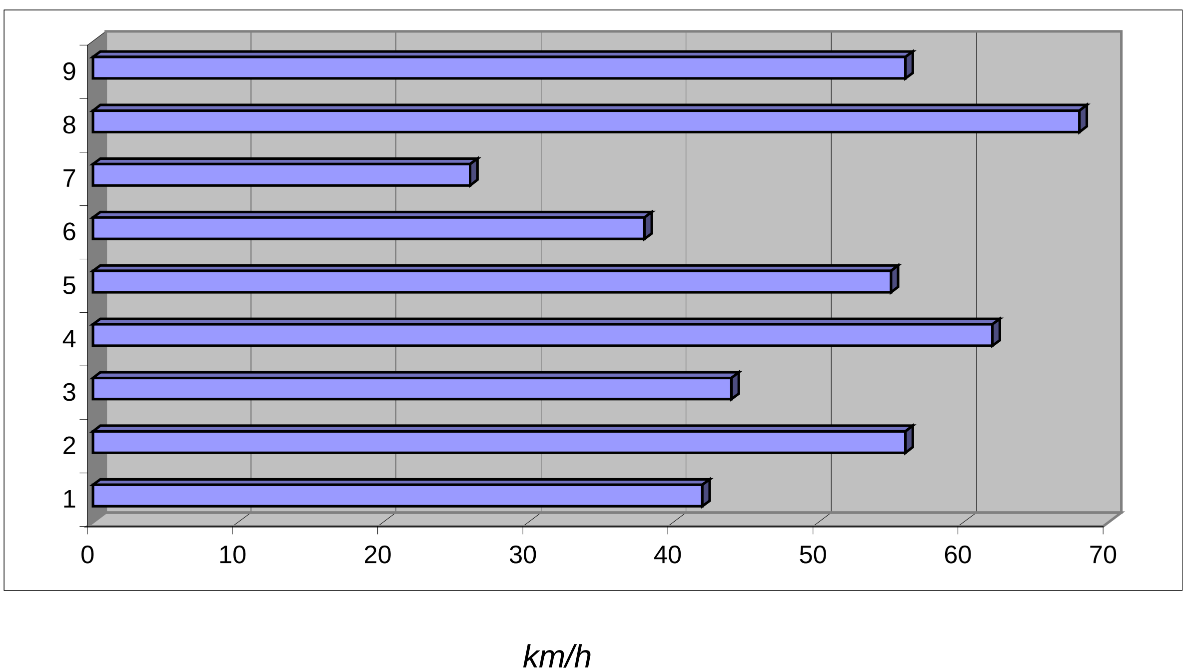


Diagram 6 : ***Camera 2:*** Graphic representation of Group 11 cluster
[noted: varied velocities *Bar 76-77*]

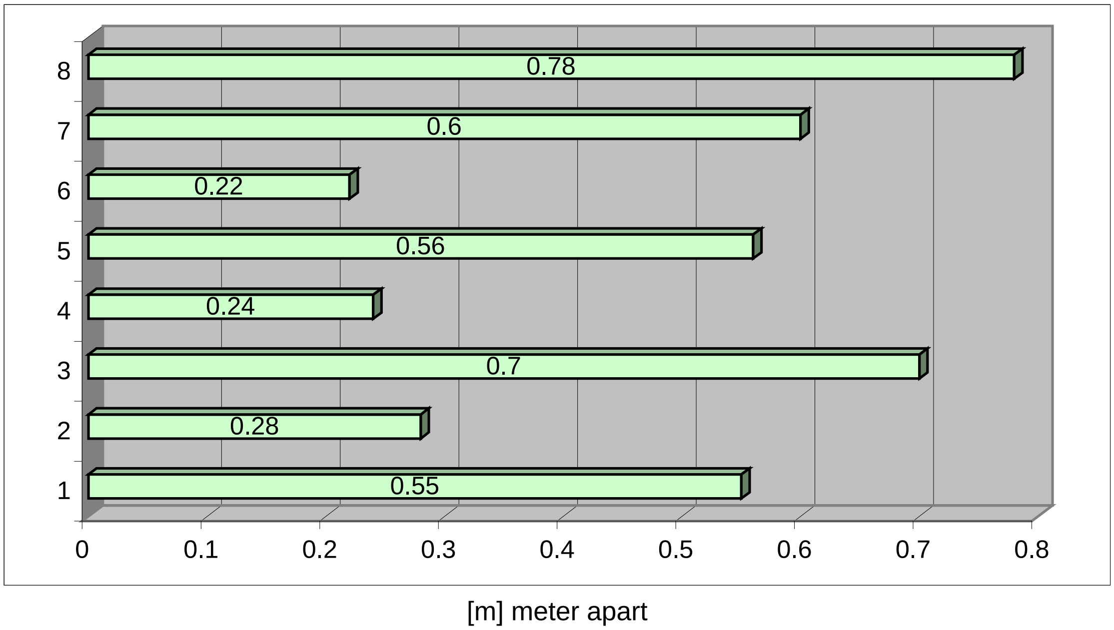


Diagram 7 : ***Camera 2:*** Graphic representation of Group 11 cluster
[noted: varied distances apart *Bar 76-77*]

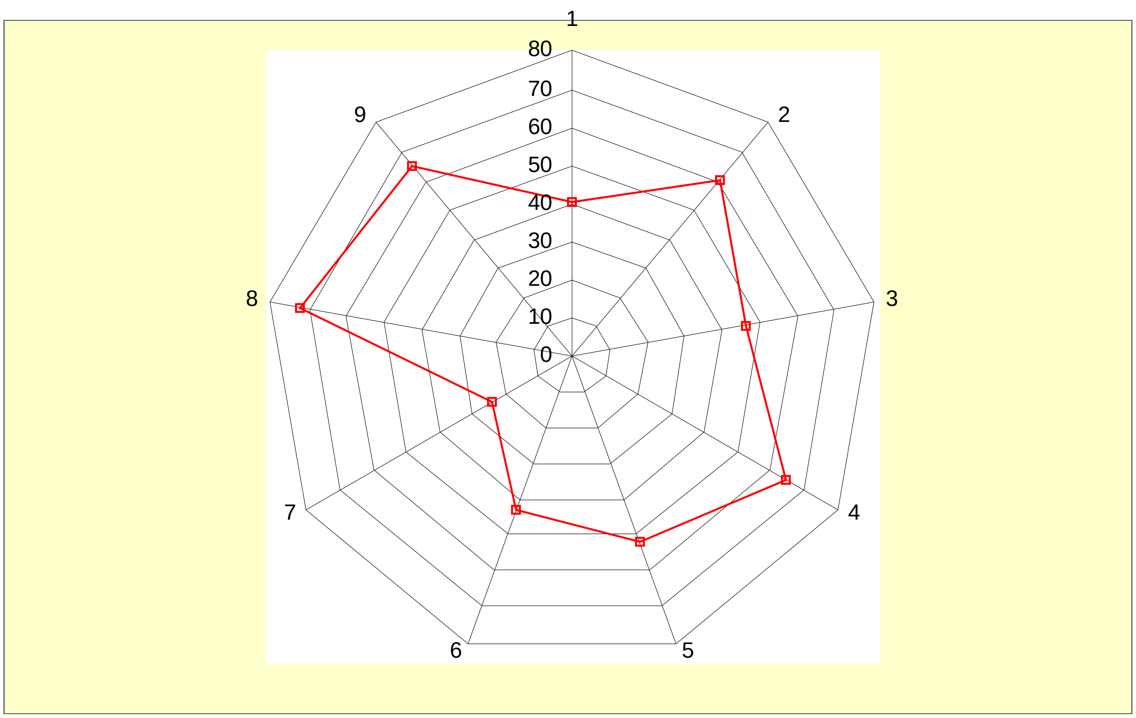


Diagram 8:

Camera 1: The proportionality constant relating to stress and strain in the linear region of vehicular motion of Group 11 Bar 76-77 graphically represents elastic behaviour

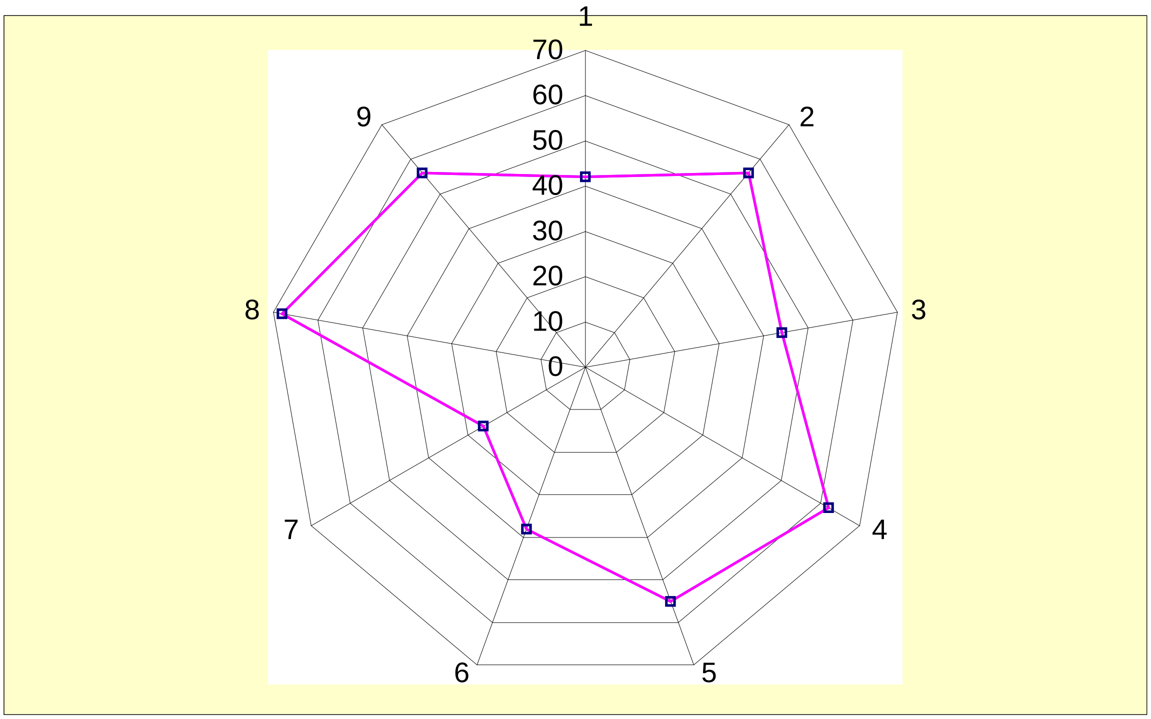


Diagram 9:

Camera 2**:** The proportionality constant relating to stress and strain in the linear region of vehicular motion of Group 11 Bar 76-77 graphically represents elastic behaviour

The role of the pianist would be:

i] To express the movement of vehicles from within mobile clusters*.
ii] Shifting the whole pattern of notes avoiding the clash of non-mobile clusters* by alternating the route of travel [e.g. from far left lane to the far right lane or to the middle lane].
iii] Interacting with the electronic sound to create the elastic behaviour as noted at particular instances in the data recordings.

*Clusters / platoons form spontaneously due to the differences in inherent velocities thus no passing is allowed [single lane formation], then platoons form behind the slowest cars so that the performance of the system is solely determined by the fraction of the slow cars. Each car (agent) has its own characteristics [speed, acceleration, etc.] and goals [reaching final destination in a given time, maintaining safety, etc.]. Autonomous multi–agent systems that are characterized by distributed control mechanisms are much more robust compared to systems with centralized control. The absence of a centralized control requires interaction among agents to form and maintain platoons.

This analysis formed part of an ongoing process of investigation in the communicative behaviour of sensitive microscopic environments.

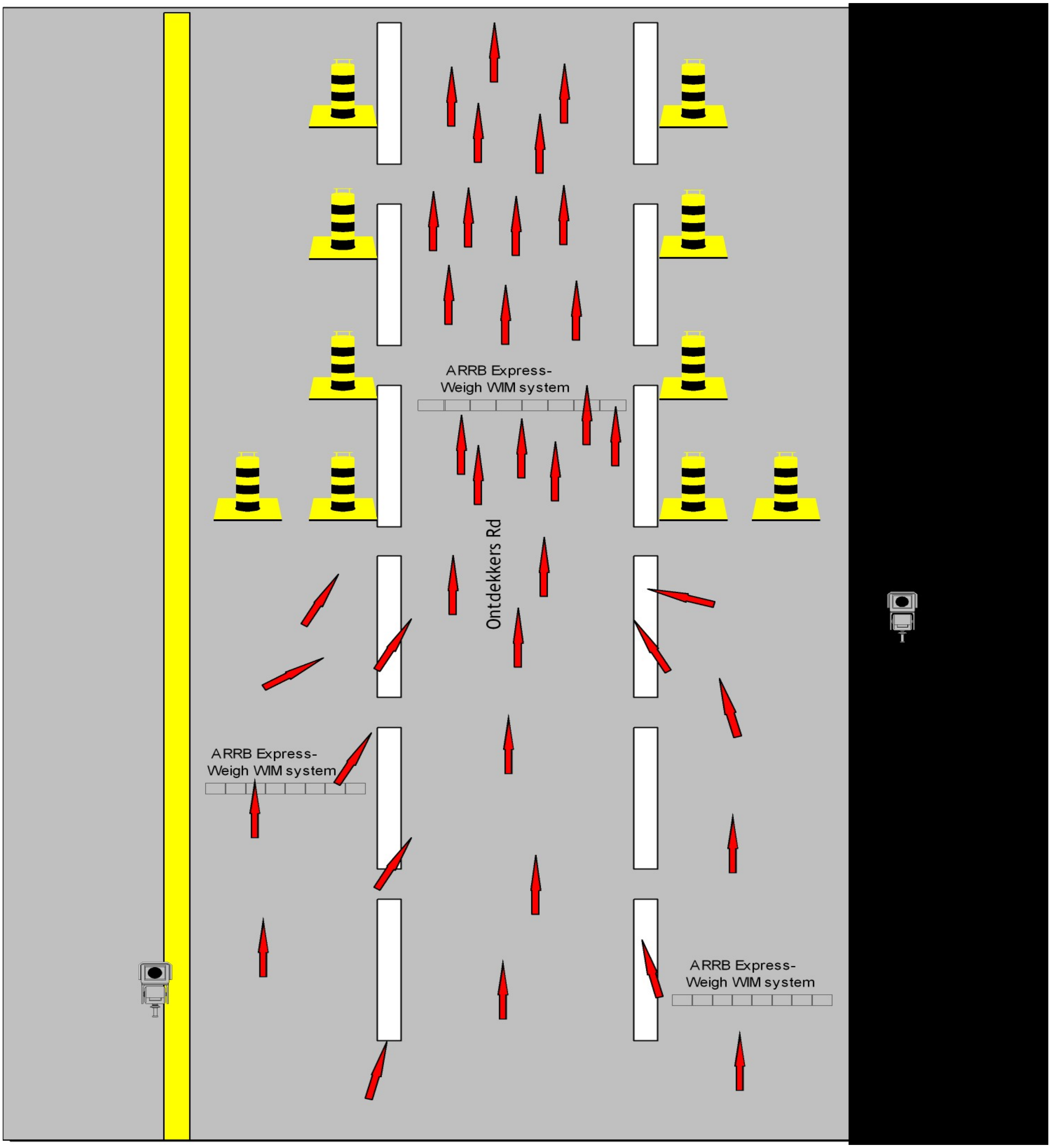
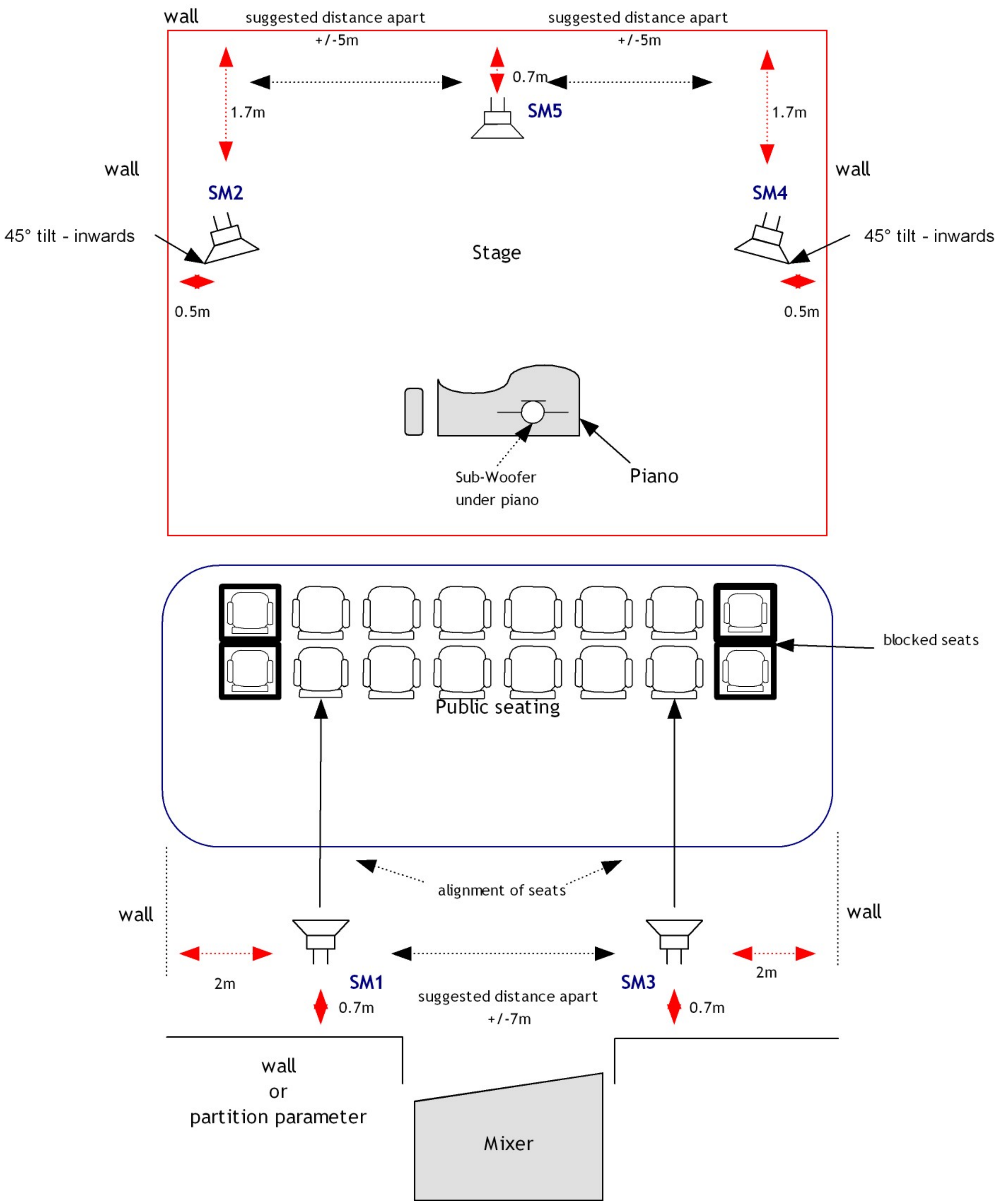


Diagram 10:

Vehicle mobility from three lanes into single lane
showing formation of clusters [platoons]

Technical requirements

Diagram 11:
Sound diffusion and projection
for [O]Rd2



Mixer ….. *[about diffusion of sound.]*

For sound engineer:

Since sound diffusion depends entirely on the acoustics of the venue, the diffusion should adhere approximately to the following specifications –

[Dials of the mixer must be from halfway up <] and there must be balance between the acoustic and digital component.

SM1 - +5 <
SM2 - +5 <
SM3 - +5 <
SM4 - +5 <
SM5 - +5 <
Sub – Woofer - +4 <

Lighting

For lighting technician:

Light must be concentrated around performer the rest of the place must be immersed in darkness during performance.
Light on performer [all lights to be turned off] must be turned off from 11min 18sec to 13min 06sec of the piece.

In conclusion

Cell motion and vehicle motion is similar this is because in vehicular motion decisions in mobility are taken by cellular matter, other similarities are of elastic potential behaviour expressed by both matter whilst in motion.

The specialized function of motion is frame dependent [velocity and mass]. In a vehicle [inorganic matter] decisions are taken by the driver [organic matter] motion can be forward and backward acceleration and left and right turning.

The specialized functions of motion in a cell is that of ameboid or ciliary.

Amoeboid motion:

Typically ameboid motion begins with protrusion of a pseudopodium from one end of the cell. The pseudopodium projects far out away from the cell body, and then the remainder of the cell moves toward the pseudopodium.

Ciliary motion:

The cilium moves forward with a sudden rapid stroke, bending sharply where it projects from the surface of the cell. Then it moves backward very slowly in a whiplike manner. The rapid forward movement pushes the fluid lying adjacent to the cell in the direction that the cilium moves, then the slow whiplike movement in the other direction has almost no effect on the fluid. As a result, fluid is continually propelled in the direction of the forward stroke. This shows that there is a mechanized structure in a particular cell that propels fluid.

Thus if we have to look at amoeboid motion which propels the cell via pseudopodium and ciliary motion which through mechanized means propels fluid in a specific direction. These two cellular motions show properties of elastic behaviour. When these properties of [the cell] motion are superimposed and compared to vehicular motion the following comparative differences result. We can thus speculate and say that 1] cellular – pseudopodium can be compared to wheels in a vehicle, similarly 2] cellular – cilia [mechanized structures] can be compared to mechanical properties in a vehicle.

It is genetically an inborn need that what man senses and absorbs he needs to give back to the environment so that he can manipulate and satisfy his materialistic needs *[© Dimitri Voudouris - ONTA PDF]*. The circulatory system is a portal means of transport – involved in exchanging of necessary cellular nutrients. By extending out of the body Man has fulfilled this need of reaching far distances [*point A to B and back*] by the development of an automotive machine behaving in action similarly to *cellular matter in motion*.

If we superimpose these properties of cellular behaviour into one, we land up with a mechanized structure composed of properties similar to a vehicle. The only differences are that the cell shows elastic behaviour all the time as part of its motion whereas in a vehicle this action is only seen during cluster formations.

Due to this action of motion it was possible to freeze moments, study and analyse them and convert them into an audible range of frequencies where they can be actively performed by a pianist [the driver] against a backdrop of electronic signals *of cluster formations* from data collected.

References:

1] HG.DAVIES AND GA. HICKS – MATHEMATICS FOR SCIENTIFIC AND TECHNICAL STUDENTS : Page 35 – 74.
2] KANE AND STERNHEIM – PHYSICS SI VERSION : Page 150 – 164.
3] ARTHUR C. GUYTON – HUMAN PHYSIOLOGY : Page 22 - 25