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IMPACT ASSESSMENT OF NOISE ANNOYANCE DUE TO DIFFERENT SOURCES OF URBAN ENVIRONMENT

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ABSTRACT

Annoyance due to noise is among one of the well-established aspect to understand deleterious effect of noise. Noise can harm us in more ways than we can think off. Previously, effect of noise on health is often misunderstood, not noticed or unrecognized. But now lot many study had been conducted in past years to understand the level of noise and predicted health hazard. However, very little consideration has been given to identify different sources of noise at urban areas and their possible contribution in annoyance. Ten different areas viz; Civil Lines (S1), Rambagh (S2), Mahewa (S3), Bhairahna (S4), Chowk (S5), Katra (S6), Naini (S7), Civil line bus station (S8), Zero road bus station (S9) and Railway station (S10) from the urban Allahabad had been selected as a representative of different zones. These areas been survey for the different sources viz; Train (TR), Road traffic (TF), Loudspeaker (LS), Vehicle horn (VH), Aeroplane (AP), Entertainment (ET) Instruments/ appliances (IM), Speech loudness (SL). A questionnaire is prepared and randomly selected subjected were told to provide the number (1 – 8) to different source as per their feeling of annoyance. Study suggested that for all selected area noise annoyance due to traffic is the major contributor. However, people felt more annoyed because of sound of horn in vehicles (19.9%) over the noise of traffic congestion and friction (17.7%). Respondent responses suggested 7% - 10% because of railway. Entertainment source (radio/TV), other machines/appliances and loudspeaker was found to create almost same level of annoyance viz 13.4%, 13.2% and 12.9 % respectively as suggest the statistical analysis of data through analysis of variance. This study also reveals that in absence of high noise level sources people sense same level of annoyance with relatively less noise creating sources as in inner sectors in absence of high traffic load or loudspeaker respondent's sensitivity towards entertainment sources and other mechanical devices increased so do the feeling of annoyance. This all reveals that concern of noise annoyance is more based on persons attitude toward that sound although still we can safely say that in urban areas prevailing source of noise is traffic based but loudspeaker, entertainment devices and appliances also among the sources which are need to be taken into consideration while studying the annoyance aspect due to noise in urban setting.

Key words: Noise pollution, Annoyance, Sources, Urban, Respondents, inner sector etc

Introduction:

Noise pollution needs no introduction now as it being well-established fact that we are victim of this nonsense that enters in our life silently. Series of data are generated in last 40 years to understand the level of noise at different places and the way it is messing up with our health status **(G. B. Cannelli, 1973; Singh, 1984; Hanes, 1998)**. Recent studies conducted in other countries and in other cities of india **(Zannin *et al.,* 2006; Stassen, *et al.,* 2009 and Karmaker, 2009)** strongly evident an increase in noise level

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for all type of areas. However most of the of the studies are either based on noise level of the areas **(Ravichandran *et al.,* 1997; Pandya and Verma 1997 ; Maithani *et al*., 1998),** with in reference of the traffic noise at main road, intersection and highways (**Calixto, *et al.* 2003; Lal *et al.*, 2006; Pathak *et al.*, 2007; Al-Mutairi *et al.,* 2009)** or conducted at some construction site, airport and particular industries (**Kumar *et al*., 2008; Murphy, et.al*.,*2009; Roozbahani, *et.al.*2009**) to evaluate the noise level and risks. Traffic induced noise so far has been proven having detrimental effect on annoying the suspects in the vicinity **(Patil, *et al.,* 2011).** However, there is less literature available on noise sources other than transport sectors excluding industrial noise. We anticipated that it is also an important aspect to identify other noise creating sources in urban areas and their contribution in creating annoyance among the people exposed to that area. Noise is reported to become noxious stimulus to induce stresses **(W. Babisch, 2005)** and increases annoyance significantly triggers lots of other negative social behaviour **(Goines and Louis, 2007).** The results of annoyance are privately felt dissatisfaction, publicly expressed complaints to authorities and the adverse health effects already noted **(WHO, 1995).** Given that annoyance can connote more than slight irritation, it describes a significant degradation in the quality of life, which corresponds to degradation in health and well-being **(Bluhm, *et al.,* 2004).** Present study was conducted to identify different sources of potential noise creator in common urban setting and the people responses against the possible level of annoyance they feel at personal level.

Material and Methodology:

Allahabad is one of the important cities in India and is a centre of cultural, religious and educational activities. It is located on map at a longitude of 81^0 56’ E and a latitude of 25^0 26’ N. Allahabad has been ranked the world's 130^{th} fastest growing city (Nagar Mahapalika Allahabad, population growth rate: 2.09 per cent, 2011) with 59, 54, 391 residents presenting all type of living standard ranging from business class to labour, official to student and illiterate to highly educated. Every year this city is visited by large number of visitors belong to different group ranging from religious to official visitors and students to find it a place of carrier building. For this city is well supported by public utility facility like numbers of railway stations, bus stands, commercial places and other hospitality structure. City like Allahabad has no clear-cut demarcation of different areas viz residential, commercial or industrial zones. Almost all the areas have mixture of two or more sectors. Ten different areas viz; Civil Lines (S1), Rambagh (S2), Mahewa (S3), Bhairahna (S4), Chowk (S5), Katra (S6), Naini (S7), Civil line bus station (S8), Zero road bus station (S9) and Railway station (S10) from the urban Allahabad had been selected to carry out the above mentioned study.

Civil Lines: Site S1 is a representative of high-class living standard with well-developed residential zones. It also regarded as a centre place for marketing along with important government and non-government offices. Sighted area is having major source of noise road traffic, loudspeaker, machine and generators.

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Rambagh: Site S2 represents residential zones with market and commercially active centres having bus and auto stand. Two different railway tracks pass through and rambagh railway station is nearby. Here road are not very wide and always having a massive traffic load including light, medium and heavy vehicles. This area has an ancient temple of lord Hanuman and famous hospital Jeevan Jyoti making this place more crowdie during visiting hours. Loudspeaker noise is not uncommon in addition to other sources.

Mahewa (S3): Site S3 is located at trans-Yamuna having it importance due to Agricultural university SHIATS. University campus area is encircled by NH27 however, inside the campus and nearby residential area is no loaded with much traffic. But loudspeaker, temple bells, music are generally sighted.

Bairahna: S4 is basically a residential area with schools, hospital and small market situated along the side of main road. It adjoins NH1, NH2 and NH27 to the Allahabad city along with being juncture area for Sangam and Naini. Noise of vehicles, generators and music from music shops are very common during day time and at night there is a crowd of heavy vehicles getting pass after no entry duration.

Chowk (S5): Site 5 is old city area and hub of whole sale market of Allahabad. Although main adjoining roads are wide but no dividers are provided. Main market area is having narrow roads and being whole sale market mini trucks and good vehicles are very frequent making a complete mess of traffic. Common noise source sighted were generator and loudspeaker.

Katra: Site 6 has it importance because of hosting University of Allahabad, colleges, district court, major state government offices, hostels, well develop old and new residential area along with student activity center. Aanand-bhawan, now become a museum along with planetarium. Inner roads of some residential portion are not well maintained and made up of common brick. All type of noise sources are seen here.

Naini: Site 7 encircled with developed industrial area located at Trans-Yamuna zone of Allahabad. Sampling site was embarked by area near to railway station, naini market and Mirzapur highway having few industries on sides along with residential zone in small patches. Most of the industries are on the one side of highway and market on the other side. Inner zones of these areas does not have very heavy traffic however industrial area has siren sounds and market area with some loudspeaker and generators. Still these sounds are time bounded and most of the people are adapted to it.

Civil line bus station: Site 8 is a commercially active zone hosting main bus station, Income tax office, Hanuman mandir, Hospital and degree colleges, DIET office and hotels. Adjacent roads are wide having divider with food corners including KFC and automobile repairing shops at the sides. The road adjoins old area of Allahabad with civil lines. Loudspeaker, temple bell and generators are among common sources.

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Zero road bus station: Site 9 is associated with old bus station of Allahabad city although frequency of buses halt has been decrease because of another bus station. Area was crowdie because of traditional whole sale market of electronic, grocery and other edibles. The main road is also not wide and hardly enough space for proper management of bus movement, which put pressure of traffic jam at this area. Mixture of different type of noises can be experienced in this area with varied sources.

Allahabad railway station: Site 10 is most busy and crowded locality of the city. Area expose to high noise level due to continuous announcements, train siren and noise make by overload of passengers, hawkers, buses, Autos and other personal vehicles. Area is having congested market, hotels, residences and bus stoppage for buses to Delhi. Roads are not very wide as per the requirement and traffic is not well managed results in traffic jam.

During the first stage of study these area were survey for possible source of noise, which was identified with self-presence, and also by enquiring the people basically reside in that area. Once the sources were identified they are categories into 8 possible categories viz Train (TR), Road traffic (TF), Loudspeaker (LS), Vehicle horn (VH), Aeroplane (AP), Entertainment (ET) Instruments/ Appliances (IM), Speech loudness (SL). Now the questionnaire has been prepared assuming all of them as a source of noise not sound thus may have some impact on the individual in term of annoyance and all of us (common people) exposed to these sources almost daily in our life. For better understanding all the area were divided in core zone (main section and road) and inner zone (at least 100 m away from main roads). From each site, 200 respondents (100 from core and 100 from inner) were selected and over all 2000 subjects were interviewed. Subject's selection was based on random selection with strict scrutiny that they were either resident of the area or at least they have day time (minimum 8 hours) exposure in that area and the age varies from 20 to 45. Simultaneously considering the data analysis as a crucial job when it comes to statistic for non-technical background researcher we tried to put general approach of data analysis through simple statistic by modifying the use lekert scale basically use for social survey **(ISO standard 15666:2003)**. It uses point scale where ordered statement varies from not annoyed to highly annoy through a series of middle lines statements. With the assumption rather examining the sources on separate 5 point lekert scale (not annoyed, slightly, moderately, very and extremely annoyed) , based on 8 category 1 to 8 marks are provided to fill in the boxes as per subjects priority to his level of feeling of annoyance for all the sources. On the basis of total scoring on annoyance scale at different site categorization of annoyance level (Not Annoyed 1 – 2, moderately annoyed 2 – 4, Annoyed 4 – 6 and highly annoyed 6 – 8) is attained. And further using it as a base level of annoyance due to different source have been documented (Table 5 – 6 and Figure 3.1 to 3.20) for different site at core and inner area separately. Later for statistics, data is been analyzed through student t test and analysis of variance which is easily understandable to all type of research generation.

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Result and Discussion: There are many prevailing sources working towards noise generation creating annoyance among the people of the locality. Noise sensitivity is a specific predictor of psychological ill-health and may be part of a wider construct of environmental susceptibility. Noise sensitivity may increase the risk of psychological ill-health when exposed to road traffic noise. Noise annoyance may be a mediator of the effects of road traffic noise on psychological ill-health (Stanfield et. al., 2016)

The noise pollution profiled for Lucknow city **(Kishu, *et al.,* 2006)** suggested that automobiles, construction, festivals, factories, stations, diesel shades, garages and workshops are among major sources of noise. This study confined towards the specific sources, which generally a part of urban life style to which majority of people exposed in their daily routine. Comparison in between the sites (Table 1) suggested that for all selected area noise annoyance due to traffic is the major contributor. However people felt more annoyed because of sound of horn in vehicles (19.9%) over the noise of traffic congestion and friction (17.7%). Respondents from S3 states (19.8%) and S10 states 19.3% of annoyance is due to traffic on road while annoyance due to vehicle horn ranged from 19 to 21% for different sites. Those who reported high overall noise annoyance showed impaired mental health compared to those who were not annoyed. High noise annoyance is associated with impaired mental health and that this association can vary with the source of environmental noise. Highest noise annoyance category suggested road traffic (Hammersen et. al., 2016).

Recently study on noise at Dubai states **(Elmehdi, 2014)** traffic annoyance was more over railway annoyance. Further in a study at Calcutta **(Chakraborty, *et al.,*1997)** suggest that for all the site L_{eq} ranged from 81.3 dB A to 92.1 dB A and L_{dn} ranged from 84.7 to 95.4 dB A and major contributor were traffic load. Most of the studies indicate that major sources of noise are road traffic and railway tracks. But present study indicates that train noise is site specific. As a city, there is less room for annoyance creating due to trains. Respondent responses suggested 17.7% of annoyance contribution goes to train at S10 (railway station) otherwise, for rest of other site very small number of respondent took it consideration for higher value (6 – 8) at scale over (2 – 4) by majority of respondent thus annoyance contributing percentage is low (7% to 10%). European Commission Report, 2011 states that railway noise seems to less serious problem than road traffic as very less population expose to railway noise. Further exposure of same level of railway noise is likely to result in less annoyance in comparison to traffic exposure of same noise level **(Meidema and Oudshoorn, 2001; Schreckeberg, *et al*., 1998).** However there are evidences of strongly negative effect on resident due to rail and road noise **(Urban And Maca, 2014)** as high speed train in Japan and Korea found responsible for creating more annoyance at same level of noise (**Morihara, *et al.,*2004; Lin, *et al*., 2006).**Entertainment source (radio/TV), other machines/appliances and loudspeaker was found to create almost same level of annoyance viz 13.4%, 13.2% and 12.9 % respectively as suggest the statistical analysis of data through analysis of variance. Loudspeakers are invariable part of indian social life but are responsible for many sound induce illness **(Bhargawa 2001).** A cross-

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section survey of the population in Delhi state points out that the main sources of noise pollution are loudspeakers and automobiles **(Singh and Davar, 2004).** Another study at Delhi suggested that apart from the traffic noise as a major source of noise pollution (70.5%) loud speakers (63%), generators (52.9%) and factories (36%) were sighted as the other sources of noise in urban sites **(Lal, *et al.*, 2006)**. There are evidences that the noise level produced by household equipment and appliances sometimes reaches up to 97 dB, which is more than double the acceptable (45dB) noise level **(Nagi, *et al.,* 1993)**. Even some times noise generated from road, railway traffic is responsible of listening music, radio, TV at high volume, and louder voice is used for communication results in creating annoyance to the people **(Schuemer-Kohrs, *et al.,* 1998).**

Table 1: Noise Annoyance in percentage at different sites due to different Noise Sources

S.No.	Noise sources	Annoyance percentage at different sites										Ann. of variance
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	
1	Train	8.2	10.6	6.5	8.1	7.2	9.0	9.6	8.2	6.9	17.7	9.2 d
2	Road traffic	17.0	19.8	16.0	17.4	15.4	18.9	17.7	18.3	15.2	19.3	17.5 b
3	Loudspeaker	13.6	13.4	13.5	13.3	14.0	14.2	14.1	13.0	13.7	9.1	13.2 c
4	Aeroplane	3.2	2.8	2.8	3.0	2.8	3.7	2.8	4.2	3.0	2.8	3.1 e
5	Vehicle horn	19.3	19.7	20.5	20.5	19.1	20.7	20.2	19.6	19.7	19.8	19.5 a
6	Entertainment source	14.6	12.4	16.9	13.4	15.3	9.7	10.0	11.2	16.9	13.7	13.4 c
7	Appliances/Machines	13.8	11.8	13.0	11.6	16.0	12.2	13.0	13.2	13.2	10.9	12.8 c
8	Speech loudness	10.3	9.4	10.8	12.7	10.2	11.6	12.6	12.4	11.5	6.7	10.8 d

Annoyance analysis is among one of the most studied aspect for effect of noise on human behavior as it aggravates further responses even the stimulation of adrenal hormones. However it's the complex one also as there is great variation in response to noise between two different persons exposing to same noise level at same time or may be same person exposed to same level of noise at different time. It has been observed that recreational and commercial places are comparatively noisier but less stressful thus impact of noise should need to take into account a real time noise exposure and their psychological condition during the exposure (Yinhua et. al., 2020). Setting a sound as noise is highly depending upon the state of person's metal condition and attitude toward that sound. In this study sites were differentiated into main section (including main roads and cross section) and inner zone (approximately 100 mts away from main road) presuming that inner area where quieter in comparison to main roads thus annoyance level due to different sources may be different (Table 2 & 3 and figure 1 & 2).

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Table 2: Noise Annoyance level on scale at Core zone of different sites due to different Noise Sources

S.No.	Noise sources	Sites										Ann. of variance
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	
1	**Train**	3.4	4.8	2.5	3.0	2.8	3.0	4.2	2.5	3.1	7.6	**3.7 c**
2	**Road traffic**	6.9	7.1	7.0	7.1	6.3	7.1	7.1	6.9	6.3	6.8	**6.9 a**
3	**Loudspeaker**	5.5	4.7	4.7	5.0	5.1	5.6	5.0	5.1	5.1	3.2	**5.0 b**
4	**Aeroplane**	1.2	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	**1.1 d**
5	**Vehicle horn**	7.3	7.1	7.3	7.7	7.2	7.5	7.3	7.0	7.4	6.6	**7.3 a**
6	**Entertainment**	3.6	4.2	4.8	3.3	4.7	3.6	3.6	4.4	4.9	4.4	**4.4 c**
7	**Appliances/Ma**	4.4	4.1	4.5	3.4	4.6	4.2	4.5	4.9	4.3	4.0	**4.6 bc**
8	**Speech**	3.7	3.2	4.1	5.3	4.2	4.0	3.3	4.2	4.0	2.5	**3.9 c**

Table 3: Noise Annoyance level on scale at inner zone of different sites due to different Noise Sources

S.No.	Noise sources	Annoyance level on scale at Sites (inner)										Ann. of variance
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	
1	**Train**	2.5	2.9	2.2	2.9	2.4	3.5	2.7	3.4	1.9	5.1	**3.0 e**
2	**Road traffic**	5.4	7.2	4.5	5.5	4.8	6.5	5.7	6.3	4.7	7.2	**5.9 b**
3	**Loudspeaker**	4.3	5.0	5.0	4.5	4.9	4.6	5.1	4.2	4.8	3.4	**4.7 cd**
4	**Aeroplane**	1.1	1.0	1.0	1.0	1.0	1.6	1.0	2.1	1.2	1.0	**1.2 f**
5	**Vehicle horn**	6.6	7.1	7.5	7.0	6.6	7.4	7.3	7.2	6.8	7.7	**7.3 a**
6	**Entertainment**	6.9	4.8	7.3	6.3	6.3	3.4	3.6	3.6	7.3	5.5	**5.6 b**
7	**Appliances/Machin**	5.6	4.4	4.9	4.9	6.9	4.6	4.8	4.6	5.2	3.9	**5.1 bc**
8	**Speech loudness**	3.7	3.6	3.7	3.9	3.2	4.3	5.8	4.7	4.3	2.4	**4.1 d**

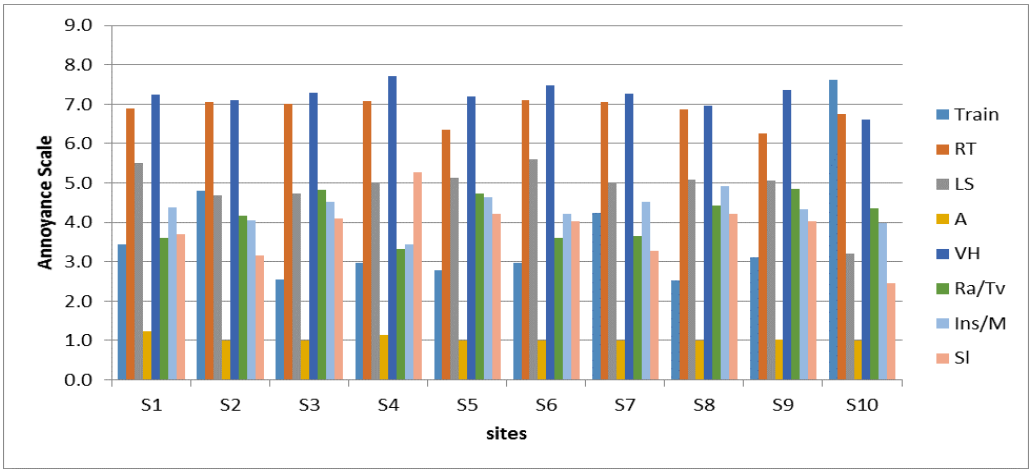

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Figure 1: Annoyance level due to different Noise Sources at selected sites for core zone

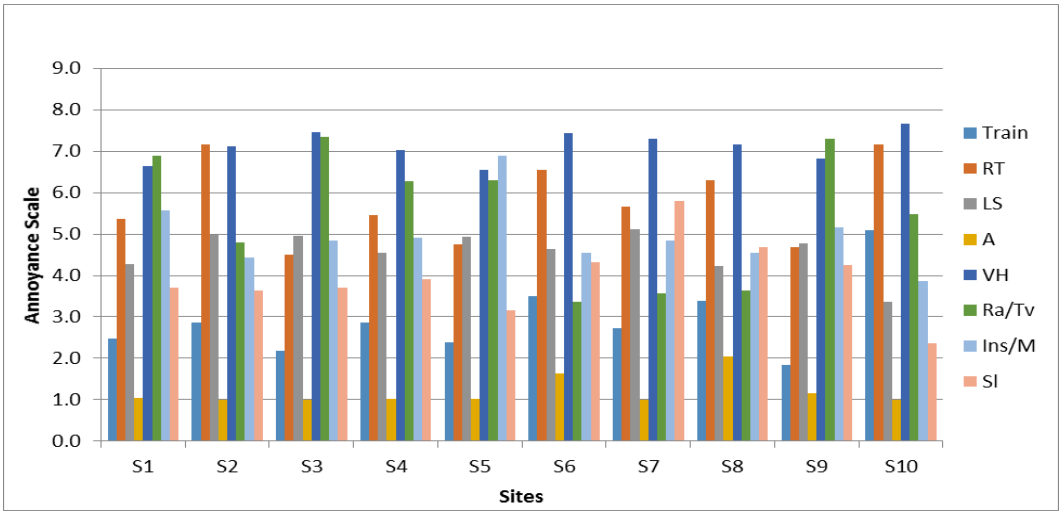

Figure 2: Annoyance level due to different Noise Sources at selected sites for inner zone

Statistical analysis for variance for annoyance scaled value suggest that at the core zone annoyance due to traffic load and vehicle horn is maximum (6.9 and 7.1) and significantly not differ to one another. While at inner zone people identified vehicle horn as a primary reason of annoyance over road traffic. Further at core zone loudspeaker has been identified as another major contributor for with annoyance level (5.0) followed by entertainment source and appliances/ machines (4.4 & 4.6) but at inner section these are prevailing (5.6 and 5.1) over loudspeaker (4.7) even loudness in communication has been gained attention (4.1). All these suggest that feeling of annoyance is strongly related to state of mind and its interpretations. In absence of high noise level sources people sense same level of annoyance with relatively less noise creating sources. That is at inner sectors in absence of high traffic load or loudspeaker respondents sensitivity towards entertainment sources and other mechanical devices increased so do the feeling of annoyance. Statistical correlation analysis (table 6 & 7) also suggest the possibility of such type of attitude as there found a significant relationship between train noise to entertainment sources, vehicle horn to loudspeaker for core zone. At inner zone train and road traffic shows significant relations with entertainment and appliances sources and loudspeaker to loudness in communication.

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Table 4: correlation analysis between different sources of noise at core zone

	TR	RT	LS	AR	VH	ET	AP/M	SL
TR	1	0.127 **(NS)**	-0.779 **(S)**	-0.106 **(NS)**	-0.411 **(NS)**	-0.044 **(NS)**	-0.301 **(NS)**	-0.798 **(S)**
RT	0.127	1	0.249 **(NS)**	0.32 **(NS)**	0.571 **(S)**	-0.64 **(S)**	-0.029 **(NS)**	0.073 **(NS)**
LS	-0.779	0.249	1	0.393 **(NS)**	0.687 **(NS)**	-0.377 **(NS)**	0.337 **(NS)**	0.606 **(NS)**
A	-0.106	0.32	0.393	1	0.486 **(NS)**	-0.666 **(S)**	-0.243 **(NS)**	0.334 **(NS)**
VH	-0.411	0.571	0.687	0.486	1	-0.485 **(NS)**	-0.056 **(NS)**	0.641 **(S)**
ET	-0.044	-0.64	-0.377	-0.666	-0.485	1	0.424 **(NS)**	-0.227 **(NS)**
AP/M	-0.301	-0.029	0.337	-0.243	-0.056	0.424	1	-0.118 **(NS)**
SL	-0.798	0.073	0.606	0.334	0.641	-0.227	-0.118	1

Table 5: correlation analysis between different sources of noise at inner zone

	TR	RT	LS	AR	VH	ET	AP/M	SL
TR	1	0.801 **(S)**	-0.61 **(NS)**	0.241 **(NS)**	0.575 **(NS)**	-0.532 **(NS)**	-0.61 **(NS)**	-0.236 **(NS)**
RT	0.801	1	-0.275 **(NS)**	0.306 **(NS)**	0.551 **(NS)**	-0.766 **(S)**	-0.647 **(S)**	0.023 **(NS)**
LS	-0.61	-0.275	1	-0.084 **(NS)**	0.137 **(NS)**	-0.117 **(NS)**	0.452 **(NS)**	0.682 **(S)**
A	0.241	0.306	-0.084	1	0.218 **(NS)**	-0.65 **(S)**	-0.216 **(NS)**	0.368 **(NS)**
VH	0.575	0.551	0.137	0.218	1	-0.561 **(NS)**	-0.545 **(NS)**	0.413 **(NS)**
ET	-0.532	-0.766	-0.117	-0.65	-0.561	1	0.318 **(NS)**	-0.498 **(NS)**
AP/M	-0.61	-0.647	0.452	-0.216	-0.545	0.318	1	0.083 **(NS)**
SL	-0.236	0.023	0.682	0.368	0.413	-0.498	0.083	1

Another aspect which has been observed during the study was adaption of respondent for certain sources. Sometime people get very much accustomed to certain type of source so that it high intensity noise may have hardly any impact on them. For example during filling of questionnaire at railway station site people at the platform were adapted to the siren of train but outside people seems to consider it highly annoyed. Further at Naini, near to one industry respondent were habitual of the duty siren and not considered it as a source of noise annoyance even the measured value of noise level from at siren ranged from 90 – 100 dBA when it blows. On the basis of categorization, annoyance level for different source at different area has been document as not annoyed, moderately annoyed, annoyed and highly annoyed (Table 6 & 7 and figure 3.1 to 3.20) This all reveals that concern of noise annoyance is more based on persons attitude toward that sound although still we can safely say that in urban areas prevailing source of noise is traffic based but loudspeaker, entertainment devices and appliances also among the sources which are need to be taken into consideration while studying the annoyance aspect due to noise in urban setting.

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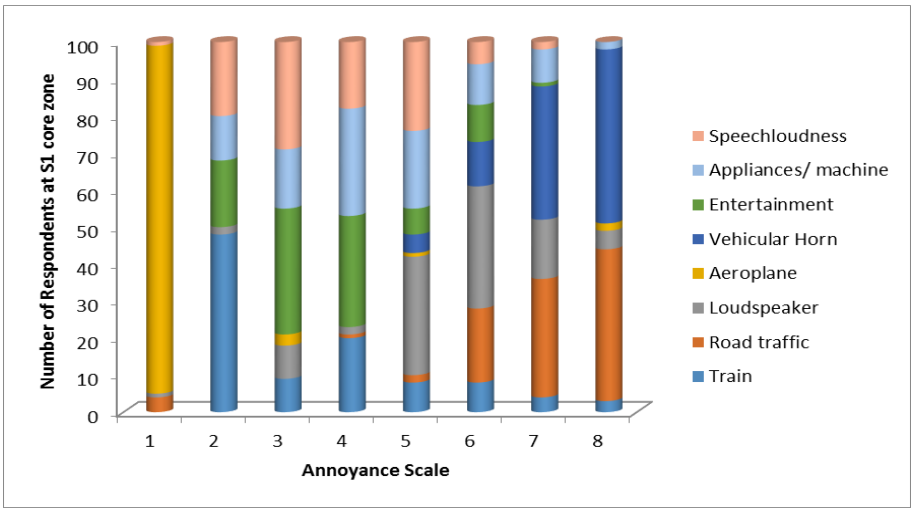

Figure 3.1: Scoring on annoyance Scale by different Noise Source at Civil line core zone

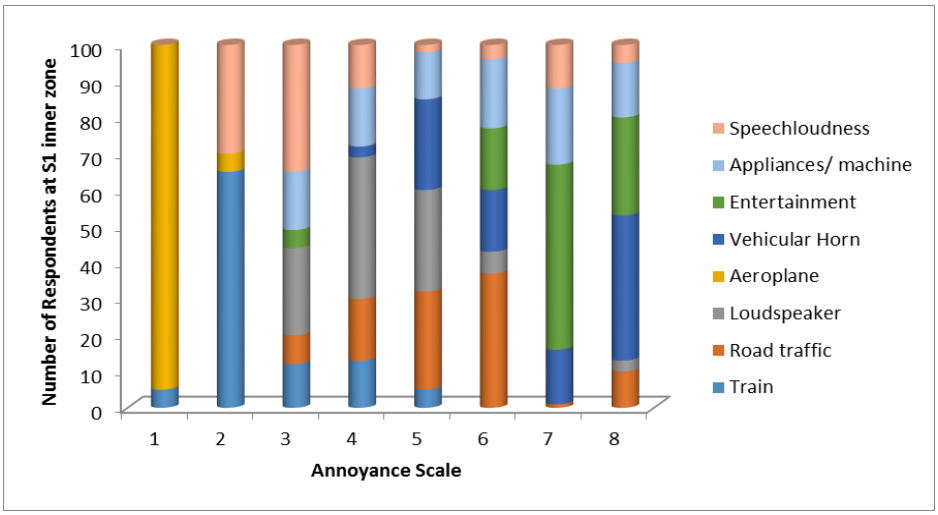

Figure 3.2: Scoring on Annoyance Scale by different Noise Source at Civil line core zone

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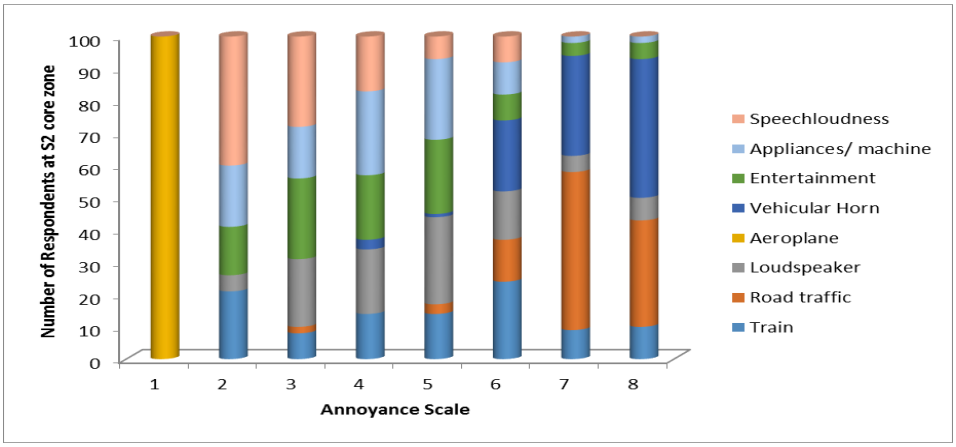

Figure 3.3: Scoring on Annoyance Scale by different Noise Source at Rambagh core zone

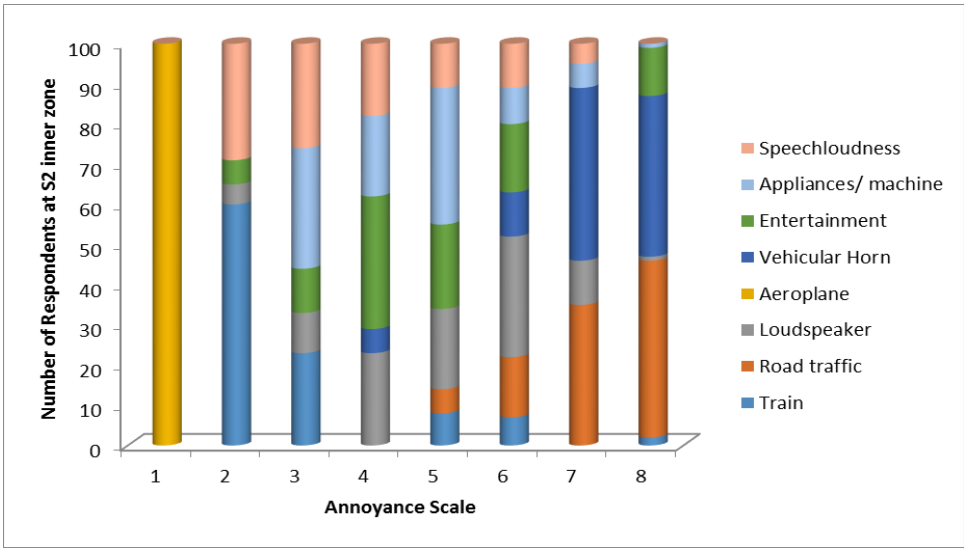

Figure 3.4: Scoring on Annoyance Scale by different Noise Source at Rambagh inner zone

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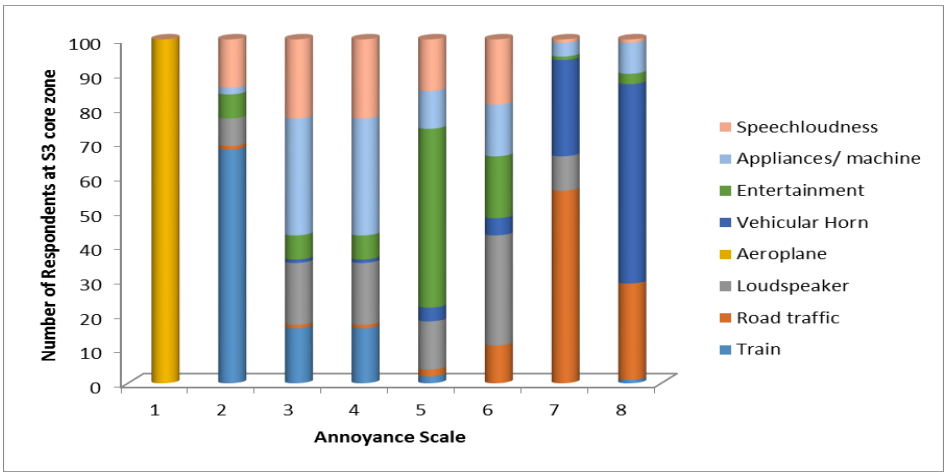

Figure 3.5: Scoring on annoyance Scale by different Noise Source at Mahewa core zone

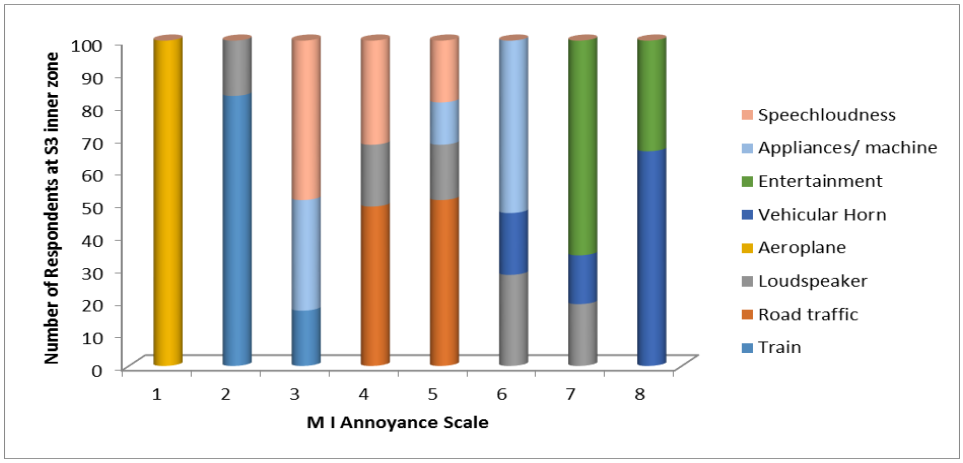

Figure 3.6: Scoring on Annoyance Scale by different Noise Source at Mahewa inner zone

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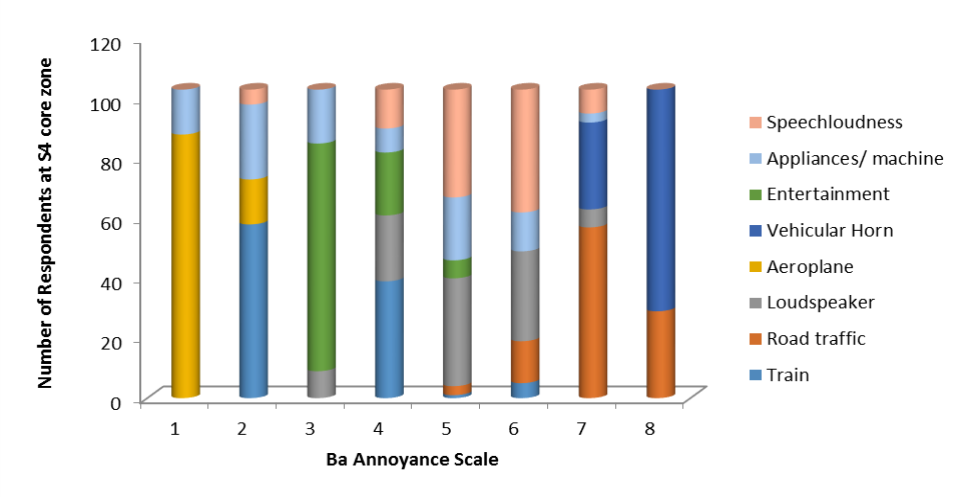

Figure 3.7: Scoring on Annoyance Scale by different Noise Source at Bairahana core zone

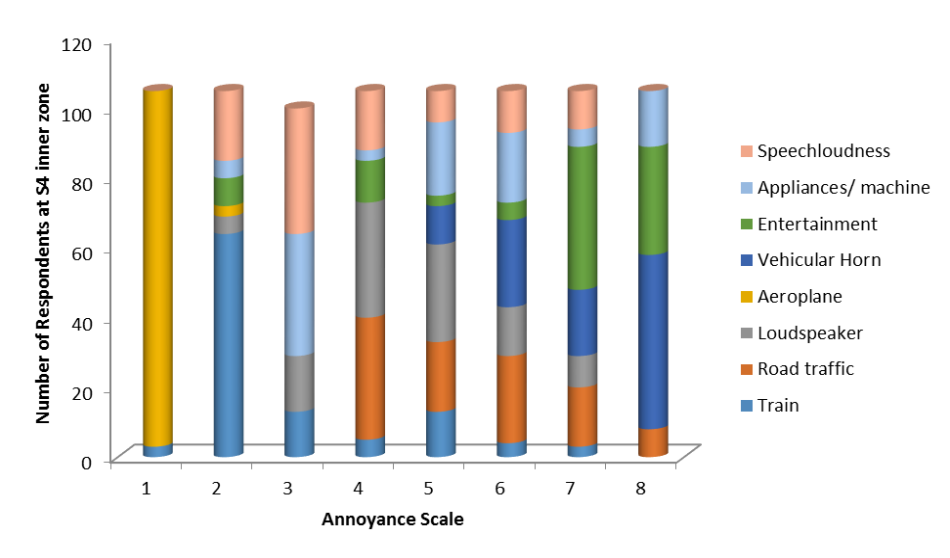

Figure 3.8: Scoring on Annoyance Scale by different Noise Source at Bairahana inner zone

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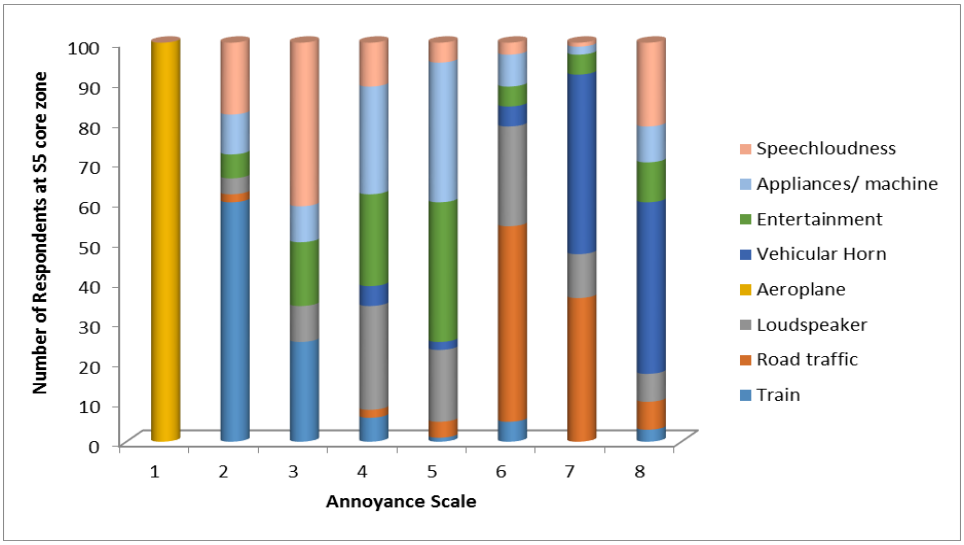

Figure 3.9: Scoring on annoyance Scale by different Noise Source at Chowk core zone

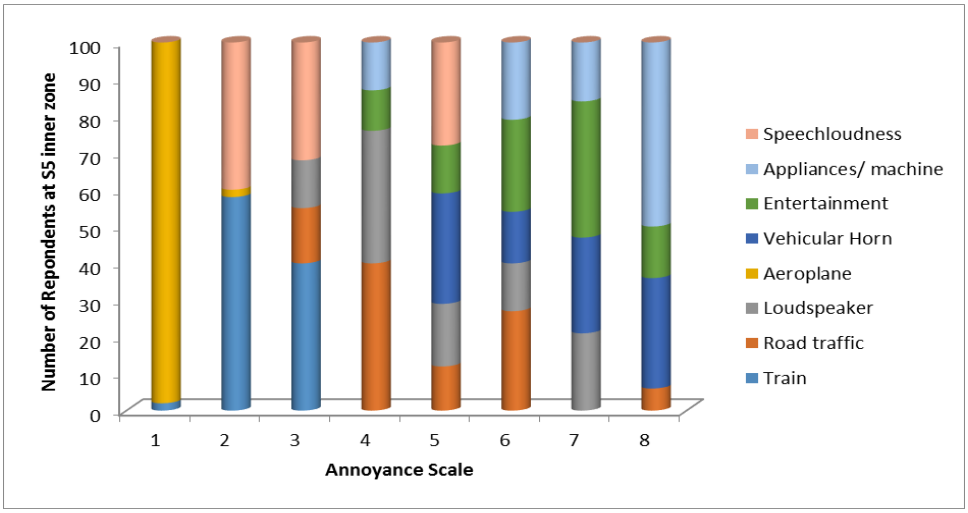

Figure 3.10: Scoring on Annoyance Scale by different Noise Source at Chowk inner zone

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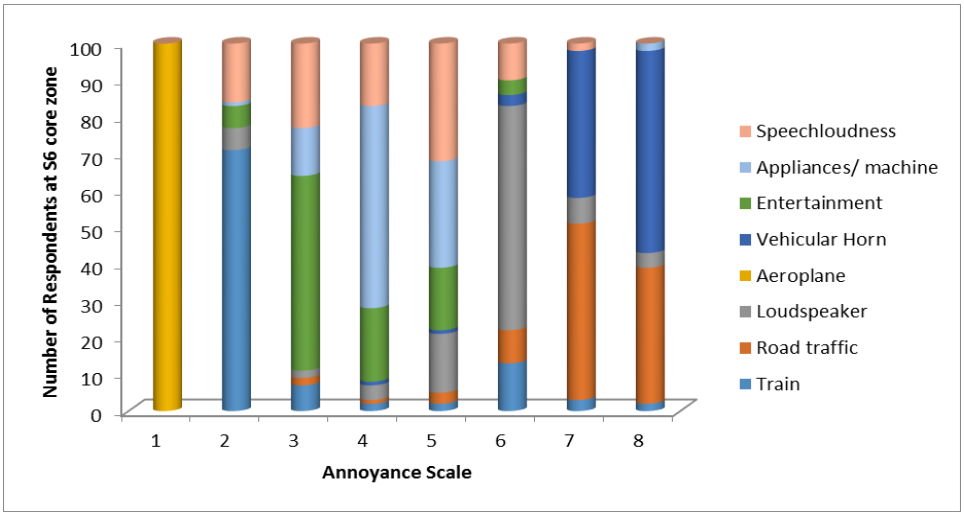

Figure 3.11: Scoring on Annoyance Scale by different Noise Source at Katra core zone

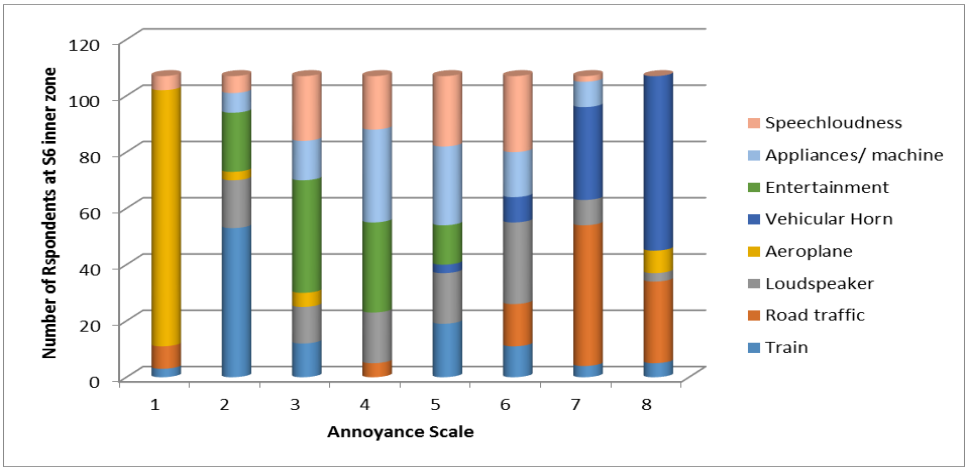

Figure 3.12: Scoring on annoyance Scale by different Noise Source at Katra inner zone

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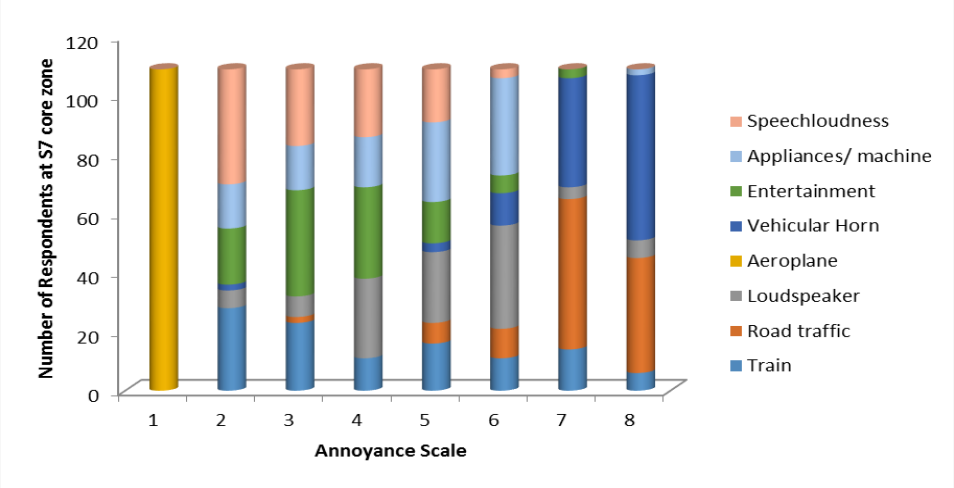

Figure 3.13: Scoring on Annoyance Scale by different Noise Source at Naini core zone

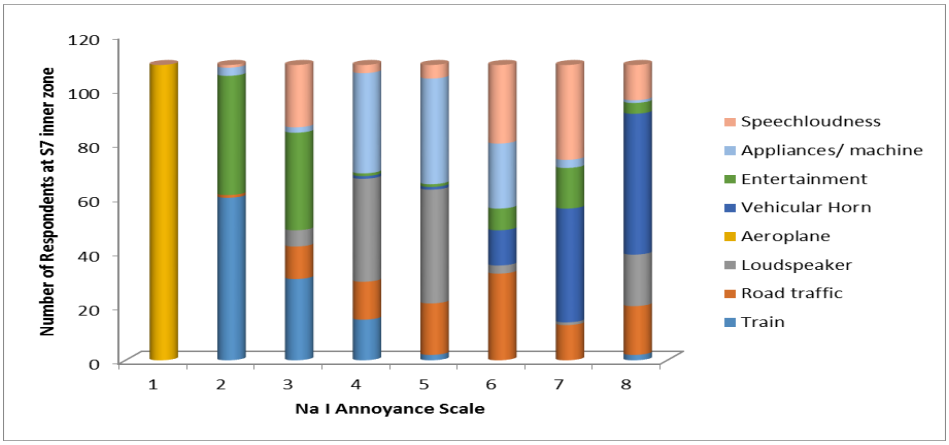

Figure 3.14: Scoring on Annoyance Scale by different Noise Source at Naini inner zone

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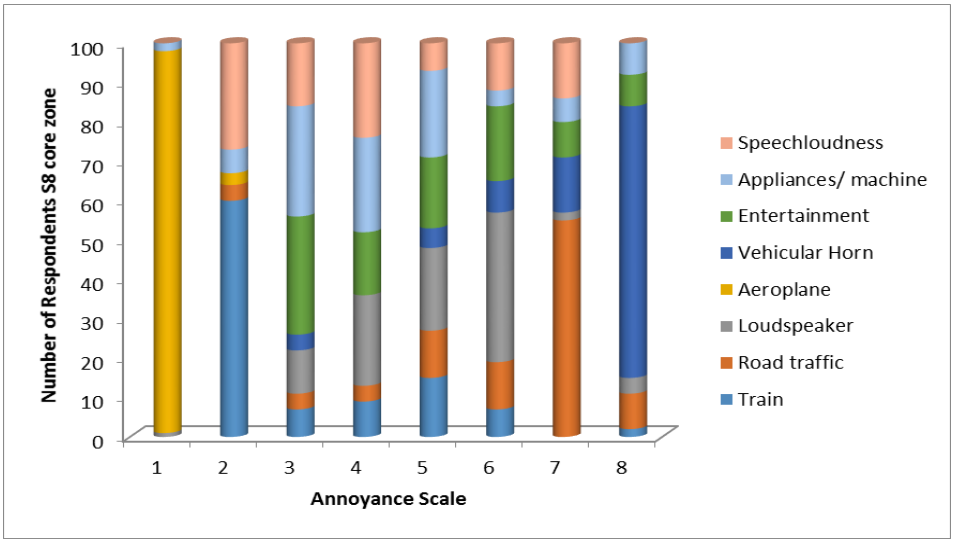

Figure 3.15: Scoring on Annoyance Scale by different Noise Source at Zero road Bus station core zone

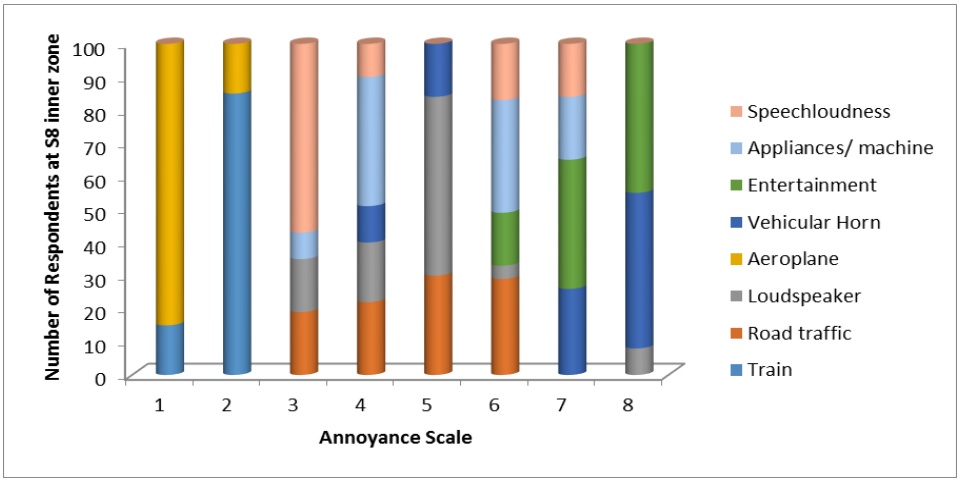

Figure 3.16: Scoring on Annoyance Scale by different Noise Source at Zero road Bus station inner zone

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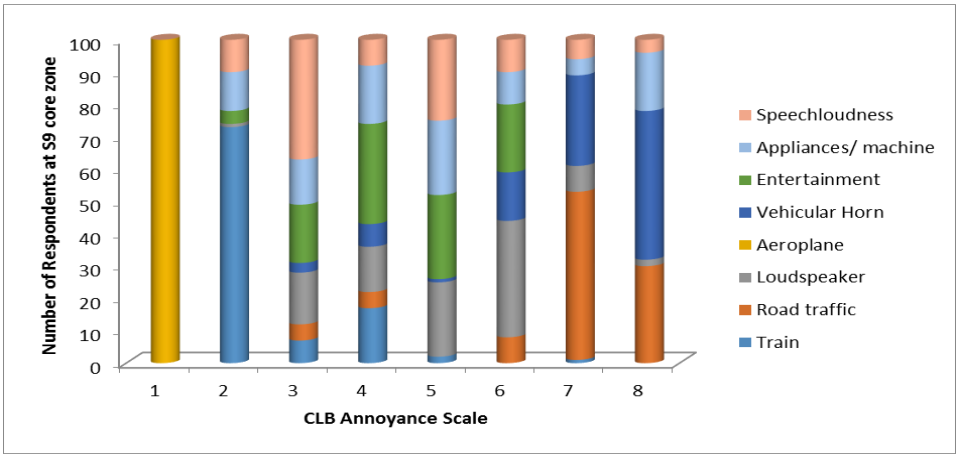

Figure 3.17: Scoring on annoyance Scale by different Noise Source at Civil line Bus-station core zone

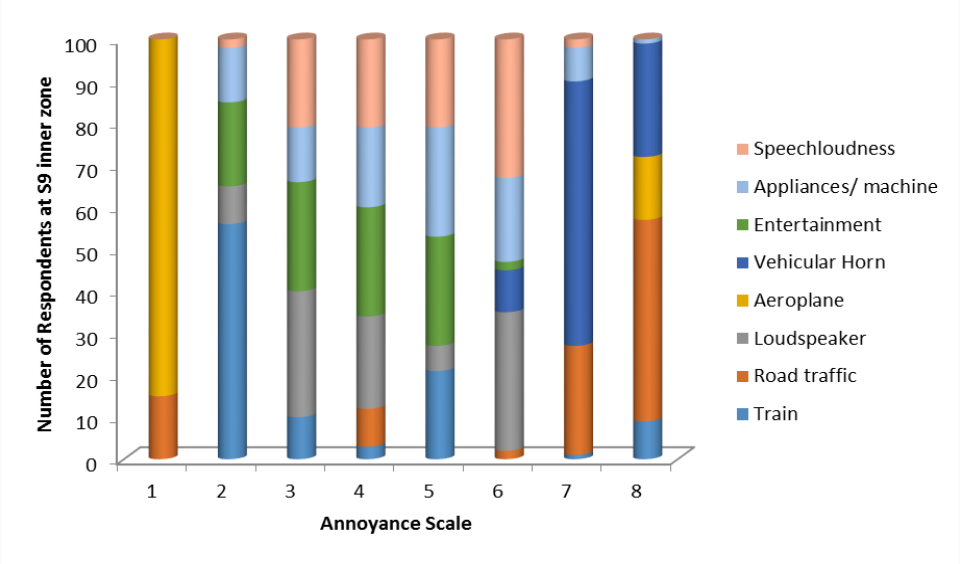

Figure 3.18: Scoring on Annoyance Scale by different Noise Source at Civil line Bus-station inner zone

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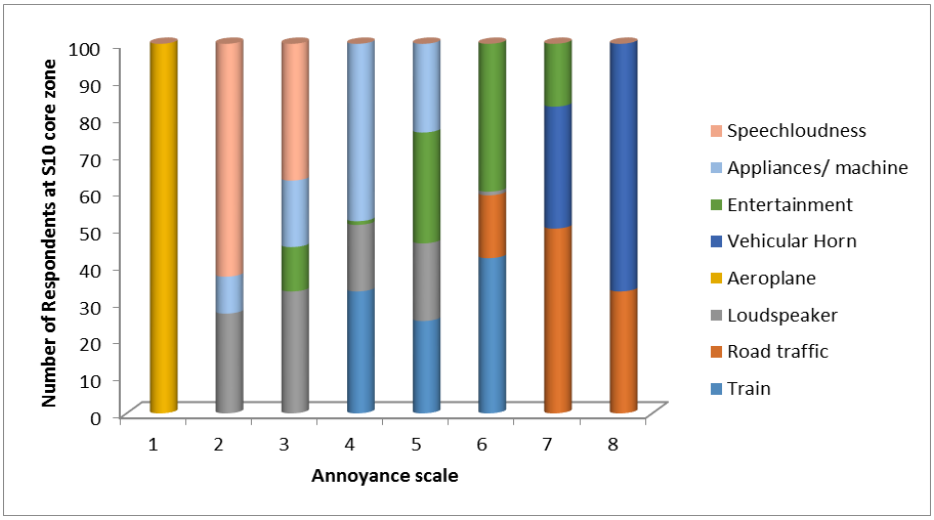

Figure 3.19: Scoring on Annoyance Scale by different Noise Source at central Railway station core zone

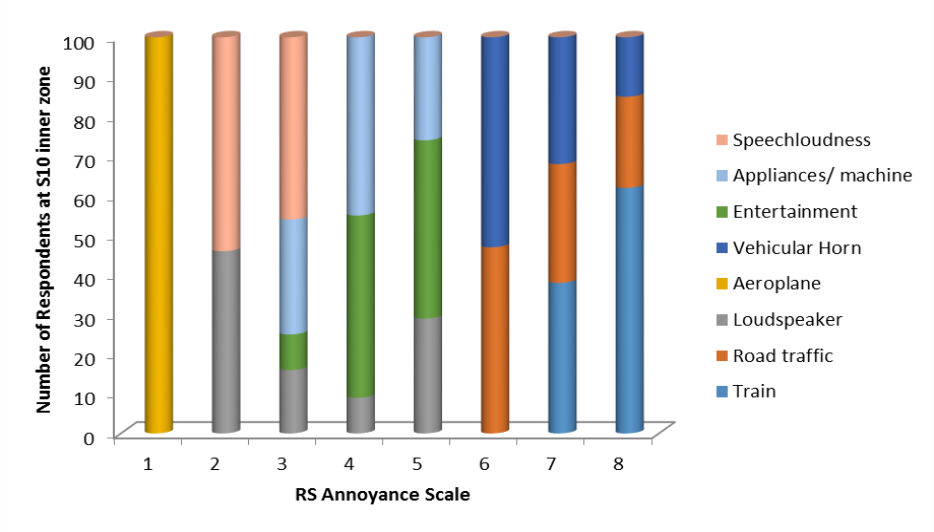

Figure 3.20: Scoring on Annoyance Scale by different Noise Source at central Railway station inner zone

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Table 6: Level of Annoyance due to different Noise sources at different sites in core zone

S.No	Sites	Scale value (1 – 2) Not Annoyed	Scale value (2 – 4) Moderately Annoyed	Scaled Value (4 – 6) Annoyed	Scaled value (6 – 8) Highly Annoyed
1	S1	Aeroplane	Train, Entertainment sources Speech loudness	Appliances/ Machine & loudspeaker	Road traffic & Vehicle horns
2	S2	Aeroplane	Speech loudness	Train, Appliances/ Machine, loudspeaker & Entertainment sources	Road traffic & vehicle horns
3	S3	Aeroplane	Train	Loud speaker, entertainment sources, Appliances/ machine & speech loudness	Road traffic & vehicle horns
4	S4	Aeroplane	Train, Entertainment sources & Appliance/ Machine	Loudspeaker & Speech loudness	Road traffic & Vehicle horns
5	S5	Aeroplane	Train	Loud speaker, Entertainment sources, Appliances/ machine & speech loudness	Road traffic & vehicle horns
6	S6	Aeroplane	Train & Entertainment sources	Loud speaker, Appliances/ machine & Speech loudness	Road traffic & Vehicle horns
7	S7	Aeroplane	Entertainment sources & Speech loudness	Train, Loud speaker & Appliances/ machine	Road traffic & Vehicle horns
8	S8	Aeroplane	Train	Loud speaker, Entertainment sources, Appliances/ machine & Speech loudness	Road traffic & Vehicle horns
9	S9	Aeroplane	Train	Loud speaker, entertainment sources, Appliances/ machine & speech loudness	Road traffic & vehicle horns
10	S10	Aeroplane	Loudspeaker & Speech loudness	Entertainment sources, Appliances/ machine	Train, Road traffic & Vehicle horns

Table 7: Level of Annoyance due to different Noise sources at different sites in inner zone

S.No	Sites	Scale value (1 – 2) Not Annoyed	Scale value (2 – 4) Moderately Annoyed	Scaled Value (4 – 6) Annoyed	Scaled value (6 – 8) Highly Annoyed
1	S1	Aeroplane	Train & Speech loudness	Road traffic, Loudspeaker & Appliances/ Machine	Vehicle horns & Entertainment sources
2	S2	Aeroplane	Train	Loudspeaker, Appliances/ Machine, Entertainment sources & Speech loudness	Road traffic & Vehicle horns
3	S3	Aeroplane	Train & Speech loudness	Road traffic, Loud speaker & Appliances/ machine	Vehicle horns & Entertainment sources
4	S4	Aeroplane	Train & Speech loudness	Road traffic, Loud speaker & Appliances/ machine	Vehicle horns & Entertainment sources
5	S5	Aeroplane	Train & Speech loudness	Road traffic & Loud speaker	Road traffic, Vehicle horns Appliances/ machine
6	S6	Aeroplane	Train & Entertainment sources	Loud speaker, Appliances/ machine & speech loudness	Road traffic & Vehicle horns
7	S7	Aeroplane	Train & Entertainment sources	Road traffic, Loud speaker, Appliances/ machine & Speech loudness	Vehicle horns
8	S8	-	Train , Entertainment sources & Aeroplane	Loud speaker, Appliances/ machine & Speech loudness	Road traffic & Vehicle horns
9	S9	Aeroplane & Train	-	Road traffic, Loud speaker, Appliances/ machine & Speech loudness	vehicle horns & Entertainment sources
10	S10	Aeroplane	Loudspeaker & , Appliances/ machine	Train, Entertainment sources & Speech loudness	Road traffic & vehicle horns

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