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U M W E L T

Noise reduction plan for Berlin - Action plan

Imprint

Editor

Senatsverwaltung für Gesundheit, Umwelt
und Verbraucherschutz
Abt. III Umweltpolitik, Referat Immissionsschutz
Brückenstraße 6, 10179 Berlin, Tel. 030 / 9025-0

Project management: Bernd Lehming

Project handling:

Horst Diekmann (Coordination), Gunnar Milbrand, Jörg Kaptain

Administration Clearance in the Core Group:

Dr. Friedemann Kunst, Heribert Guggenthaler, Horst Wohlfarth von Alm,
Dr. Jürgen Müller (all Senatsverwaltung für Stadtentwicklung)

External consultants:

Planungsgruppe Nord

Gesellschaft für Stadt- und Verkehrsplanung

Dörnbergstraße 12

34119 Kassel

Telefon: 05 61 / 8 07 58-0

Email: pqn@pqn-kassel.de

Project handling:

Dipl.-Ing. Michael Volpert

Dipl.-Ing. Antje Janßen

CS Planungs- und Ingenieurgesellschaft

Köpenicker Straße 145

10997 Berlin

Telefon: 030 / 61 20 95 - 0

Email: info@cs-plan.de

Project handling:

Dipl. Ing. Lars Bison

Sub contractor:

Dr.-Ing. Eckhart Heinrichs,
Hamburg / Berlin

Noise mapping

Project management: Horst Diekmann

Project handling: Bettina Alex, Wolfgang-Jürgen Berges

External consultants: Arbeitsgemeinschaft Lärmkartierung Berlin GbR - Wölfel Beratende Ingenieure GmbH + CO.KG, Lärmkontor GmbH, CS Planungs- und Ingenieurgesellschaft mbH, Wölfel Meßsysteme · Software GmbH + Co KG

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1 Introduction

1.1 Background

Legal Context

The increasing noise exposure during the last years – especially in the European large towns and agglomerations – induced the European Union to release the Directive 2002/49/EC relating to the assessment and management of environmental noise of 25 June 2002, the first regulation to assess noise exposures systematically and to make noise actions plans.

The European environmental noise directive was transformed into national legislation with the “Law to implement the European directive on the assessment and reduction of environmental noise”, of June 24th 2005. The Federal Immission Control Act (§47) was adjusted in accordance.

The objective of the directive is to establish a common concept to assess and control environmental noise, to prevent, to anticipate or to minimize damaging effects and disturbances through environmental noise. To this effect

- strategic noise maps to assess environmental noise exposure will be worked out, as well as
- noise action plans with short, middle and long-term measures to reduce exposures
- information and consultation with the public regarding noise maps and action plans will be effected
- information from the strategic noise maps and the action plans will be transmitted to the European commission for further community measures

The noise action plan and the noise maps are to be updated every 5 years and the EU has to be informed about the state of realisation of the measures.

The regulations of the Federal Immission Control Act in 2005 adopted the guidelines of the Environmental Noise Directive only to make concrete specifications for noise mapping. Apart from the remarks made in the annex V of the EU – environmental noise directive, there were no further considerations made regarding the implementation of the Noise Action Plan, save the participation of the public.

Relevance of the Noise Action Planning

The noise action plan is a preparatory plan, similar to the “Flächennutzungsplan – FNP” (land use plan). The FNP is the preparatory urban plan of the City of Berlin. It stipulates the type and extent of land use for the whole town area resulting from the aimed at urban development.

The noise action plan prepares measures to be implemented through directives or other decisions of the competent public administration according to the legal regulations in force. If this action plan recommends measures that have to be enforced by planning legislation, planning authorities, according to §47 Art. 6 of the Federal Immission Control Act, have to take these into account. The abidance of threshold values of the compiled measures cannot be enforced by claim, because they are not limit values.

Effects of Noise Exposure

In a metropolitan area like Berlin the impact of environmental problems can be most clearly felt. Noise, poor air quality and intense traffic in urban areas contribute to low quality of life and the lack of investments (neglected buildings). The unsanitary effects of noise and air pollution contribute to the fact that more and more affected

neighbours on strongly polluted streets move to the outskirts, whenever they can afford to. The urban sprawl of the towns produces more traffic, thus aggravating the problems.

The remaining free flats can only be rented cheaply, which in turn produces social segregation and as a consequence, the social diversity of these residential areas deteriorates. These effects diminish the real estate value of the buildings and in the long run reduce the tax revenues of the towns.

Goals and Contents of Noise Action Planning

Noise reduction action plans are made for noise sources from traffic (street, railway, aircraft). No action plan is provided for industrial and port noise sources. The regulations of the Technical Directive for Noise Protection of 1998 already rule this problem satisfactorily.

The goal of the noise action plan is to reduce environmental noise, i.e. the disturbances from noise outside buildings. The protection involves the whole space occupied by people including the residential environment.

The Noise Action Planning strategy focuses on prevention and remedial action at the sources by influencing the traffic flows. Technical measures on the vehicles themselves (tyres and vehicle combines) can only be implemented in the long run by European legislation. In the technical field, according to evidence from the Federal Environmental Office, a noise reduction of 3 dB (A) can be expected.

The following strategies should be primarily followed to obtain noise reduction from road traffic, the major noise source in towns:

- The avoidance of noise, influencing the Modal-Split in favour of less noisy traffic means such as pedestrian and bicycle traffic as well as public transport (the so called "Umweltverbund" (Environmental Network)).
- The relocation of noise pollutions by bundling exposure into spaces where few or no people are affected
- The reduction of noise pollutions through measures that provide for a urban and less noisy passenger car traffic in the road space, such as improved surfaces, a higher steadiness of speed and a greater distance between noise sources and buildings.

Active measures to reduce noise, such as street surface renewal should be prior to passive measures such as sound proof windows. The reduction of noise exposure by passive noise insulation should only be aimed at, where active measures are insufficient. Sound proof windows can be implemented, when no other measures are effective or to complement measures that do reduce noise reduction sufficiently, especially at night.

The integrated approach of the noise action plan

The Noise Action Plan does not stand alone. It is to be understood as an integral part of many urban plans. Land use plans and urban and traffic planning have a strong interactive effect on noise reduction. The goals of these plans often correspond with the goals and measures of the Noise Action Plan and represent effective potentials for noise reduction.

Especially the Municipal Traffic Master Plan pursues a variety of planning approaches that show synergies and common aims with the noise action plan. From the point of view of the Noise Action Plan the following measures are relevant:

- Measures to advance the traffic modes of the 'Environmental Network'; this has the effect to redistribute car traffic towards less noisy traffic and to take concrete noise reducing measures in the streets,
- The further development of parking area management to reduce passenger car traffic in the city centre and therefore to relieve city streets and the major access roads to the city centre,

- The development of strategies and measures of mobility management. The objective of this strategy is to move the public use environmentally less polluting traffic means by way of communicative processes and practical offers.

The extensions of the street net shown in the Traffic Master Plan have the objective to relocate and route traffic flows in a more compatible way. This also is congruent with the aims of the noise reducing planning, especially in the case where new street connections will be used to consequently relieve problematic existing roads. The simultaneous redesign towards a reduction of traffic on the roads that are to be relieved is fundamental. ¹

Measures by Steps

In Article 5 of the Environmental Noise Directive the member states are required to define limit values, starting from which measures to protect the health of the population have to be taken. This requirement has not been definitely established by the German Federal Government, therefore the State Berlin uses the expertise of the German Council of Environmental Advisors as a guideline and declares 70 dB (A) at day and 60 dB (A) at night as the prior target (to avoid of health risk) and 65 dB (A) at day and 55dB(A) at night within health provision.

The development of short-term measures (implementation within 3 to 5 years) and mid term to long term measures (implementation within 5 to 10 years) are based on these values.

Economic Aspects of Noise Action Planning

Finances are an important prerequisite for the implementation of measures. If the problems of noise, air pollution, street security, street design and urban design are treated together, an effective cost saving and quick action is possible, thus increasing the possibilities for implementation of measures and the use of synergy effects.

The possibilities of a speedy environmental relief especially in communes like Berlin due to its scarce financial means are reduced without complementary federal programmes. The staff in the responsible administrations must also be increased.

¹ The construction of the TVO (Tangential-Link-East) in Köpenick could relieve the old town of Köpenick from thorough traffic – with a noise reduction of 6-8 dB(A). A similar effect can be expected for the South-East-Link over the River Spree in the concept Area Schöneweide, especially for the highly exposed Edisonstraße.

1.2 Course of Action and Results

Pilot projects as predecessors of the overall urban Noise Action Planning

As early as Autumn 2001, the responsible Senate Administration for the Environment began (due to the long preparations for the environmental noise law - the blueprint for the European Environmental Noise Directive already existed) to develop the first pilot projects (in Köpenick and the old central quarter Mitte, as representative for other sub-centres and the central area) to search for appropriate methods to reduce environmental noise in a Metropolitan Area such as Berlin. The pilot areas were complemented in 2002 by projects in the districts Charlottenburg-Wilmersdorf (exemplary for the problematic of access roads with high residential density and shopping streets) as well as Pankow (with a high percentage of streetcar traffic). The extremely complicated coordinating mechanisms between the boroughs and the senate administrations as well as the policy makers were to be tested during its elaboration. The consultation with the public, on one side those affected by noise and on the other side those who would be affected by the measures (e.g. passenger car drivers, business people) was also a demanding process. To gain acceptance for the measures substantial information and the determination to implement pilot measures in needed.

Noise reduction from planning to implementation is a long process that can take years involving complex measures such as rerouting traffic or substantial changes of road space. With considerable skill the boroughs were able to implement some of the measures without additional financial means. This was possible by integrating noise reducing measures into other plans for instance (urban renewal of the old town).

Overall Urban Noise Reducing Action Plan

Using the experiences from the pilot projects an action plan for Berlin was elaborated in the last two years. The plan is based on noise maps that existed for Berlin since 1994 and 1998. It transpired that the HopSpot areas of that time are concordant with the current noise map made according to the Environmental Noise Directive, so that it was possible to adapt the examined areas to the current environmental noise map. Thus it was possible in 2006 to begin to work on the noise action plan, particularly because due to the high and extensive noise pollution in Berlin, a comprehensive planning procedure with the corresponding lead-time was necessary.

The noise action plan will be elaborated especially for road traffic, streetcars and above-ground subway trains as noise sources. For these noise sources in the affected streets planning methods and a concerted view will be necessary, because the existing short term technical potentials passenger cars are not sufficient.

We will complement our report with measures for aircraft and railways.

Coordination of the noise action plan accompanying planning

The elaboration of the noise action plan was accompanied by intense coordinating processes between:

- the responsible Senate Administration for Public Health, Social Services and Consumer Protection and the Senate Administration for Urban Development, as well as
- the borough administrations, which the reports presented the detailed local noise reducing possibilities in the concept areas
- further important players, for instance the Berlin Public Transport Administration (Berliner Verkehrsbetriebe (BVG)) in whose jurisdiction noise reducing measures are involved
- a Noise Reduction Planning Forum including the responsible technical agencies (Senate and Boroughs, Traffic Control Berlin (Verkehrslenkung Berlin VLB)) representatives of the political parties in the House of

Representatives and stake holders (e.g. ADAC (Automobile Club), ADFC (Bicycle Club), freight traffic representatives, the Chamber for Industry and Commerce, the Chamber of Trade, representatives of real estate industry, representatives from several health insurance companies as well as various environmental agencies)

The variety of the participants documents the need for coordination. Due to their early participation it was possible to include a number of suggestions. Parallel to this, in some of the survey areas in which the proposals for measures had reached a certain level of coordination, there was a consultation with the public in citizens' meetings and addresses to local stake holders. The borough councils were also incorporated.

The need for action to reduce noise

The Analysis in the surveyed net show a strong need for action to reduce road traffic noise.

- The threshold values of 70 dB (A) at daytime are exceeded by 15% and those of 60 dB (A) at night are exceeded by 40% on the Berlin major road net. There is special need for action to improve the night quiet.
- According to the strategic noise mapping 193.000 persons are affected by street traffic noise with noise levels higher than 60 dB (A).
- The threshold value of 65 dB (A) at day are exceeded by more than 50% and those of 55 dB (A) at night by almost three quarters of the Berlin major road nets.
- The most urgent need for action is where the greatest number of people are affected by high noise pollution (represented by a noise index LKZ).
- All roads with a high noise index form the Hot Spot net of the noise action plan; this comprehends 27% of the Berlin major street net with a total length of 310 km.

Central measures for street traffic

The overall urban noise action plan for Berlin cannot develop measures for every street with threshold values exceeding those of the action plan. Therefore detailed concepts for measures were developed for 12 areas and 8 roads that offer typical solutions for typical problem sites.

The measures developed for the concept areas and concept roads are differentiated in measures to be implemented in the short term (Stage 1) and measure options to be realised in the middle and long term (Stage 2).

Emphasis is laid on the reorganisation and improved design of street space in the concept areas. On many street of Berlin traffic is stagnating since 1998 or has diminished. These streets frequently have a very large profile that contributes to high speed driving and an unsteady traffic flow. Measures of road space design such as marking bicycle lanes on the road can

- Support the traffic modes of the environmental network
- Increase the distance between the noise sources and the buildings
- Mitigate the speed level and improve steady traffic flow (less noisy braking and accelerating) and
- Improve the quality of road spaces.

Because this noise reducing road space conception is new in Berlin, a central issue of the short-range measures is to implement 4 exemplary roads to test their feasibility and their effect. Four road spaces, selected from a variety of proposals in the concept areas, shall be redesigned within a pilot project.

Overall urban master plans were developed with proposals for measures concerning town development and traffic planning besides the plans for the concept areas and the concept roads. Additionally the overall noise hot

spot net of noise exposure was tested in respect to people affected by noise and other traffic concerns to assess the possibilities of long term strategic tempo 30 regulations.

The surveys showed that besides possible potentials to reduce traffic, in the long term in some areas, for instance Frankfurter Allee, active noise reducing measures will not have the desired effect, so that there will no other satisfactory choices than to install sound proof windows.

Special concrete measures on the rails are presented for streetcars and local railways, whose noise overlaps passenger car traffic.

Until 2013 the noise action plan will occupy itself with further problematic areas, such as Marzahn and other areas of the city, which were not treated within this plan, because the time given for a detailed area-wide planning was insufficient. This does not exclude the fact that during this time the central issues can be updated. Together with the concerned senate administrations in the boroughs they can be tackled and implemented according to the guidelines shown in the action plan.

Measures regarding other noise sources

Railway noise is a further source of noise exposure. This paper proposes concrete measures for national and local railways. There have already been first talks with the DB-AG aiming to develop pilot projects for noise reduction.

Aircraft noise as measured by the people affected, is a minor issue (see chapter 2.1 table 6) and when according to the plans, Tempelhof and Tegel Airports are closed, this problem will be solved. In the meantime the abidance of the night flight bans has a high priority. According to the amendment of the Air Traffic Noise Act, the noise protection area for Schönefeld has to be established until 2009, so that an updated noise protection for the Berlin Area is provided.

The mapped great industrial complexes are provided for, due to the strict requirements of the Technical Directive Noise of the Federal Immission Control Act concerning their approval. Harbours, measured by EU criteria, are no problem.

Future Prospects

The elaboration of further Action Plans in the coming years for parts of the town with a strong need for action is planned. For them the suggestions coming from the public will be especially incorporated. Parallel to this, the implementation and evaluation of the pilot project to test road space measures, as well as the implementation of the short term measures (respectively their examination as far as necessary). These measures are relatively inexpensive and feasible in view of the narrow budget.

Should a federal promotional program to finance communal noise reducing measures be started in the near future, it should be assessed if further more cost intensive measures such as road renewal, subsidies for passive noise protection or measures to reduce railway noise can be implemented sooner.

2 Noise Action Plan for Berlin

According to the requirements of the European Environmental Noise Directive a noise action plan makes statements regarding

- The relevant noise sources and the harmful effects produced by them
- People affected by noise
- Problems created by noise and situations liable to be improved
- Existing or planned measures for noise reduction
- Effectiveness of measures
- Measures planned for the next 5 years and beyond for a long term strategy
- Financial information, as far as available, e.g. funds, cost effectiveness analysis, cost benefit analysis

2.1 Spatial differentiation of the Noise Action Planning

The noise action plan sets a frame for the overall urban level and makes concrete statements for 12 selected concept areas and 8 selected concept roads.

■ Table 1 Concept Areas and Concept Roads for Noise Reduction Planning

Borough	Concept Area(s)	Concept road
Mitte	Reinickendorfer Straße	Beusselstraße
Friedrichshain-Kreuzberg	Boxhagener Viertel Mehringdamm	Gitschiner Straße
Charlottenburg-Wilmersdorf	Mierendorffinsel Wilmersdorf	Uhlandstraße
Spandau	Wilhelmstadt	
Steglitz-Zehlendorf	Steglitz	Schloßstraße
Tempelhof-Schöneberg	Tempelhof	Potsdamer Straße ^①
Neukölln	Neukölln / Rixdorf	Karl-Marx-Straße
Treptow-Köpenick	Ober- and Niederschöneweide	Baumschulenstraße
Lichtenberg	Frankfurter Allee Nord	Frankfurter Allee
Reinickendorf	Residenzstraße	

① partly also Borough Mitte

Further detailed analysis is made for 4 exemplary roads in the concept areas to prepare the implementation of street design measures with model character

■ **Table 2 Exemplary Roads for detailed Measures on Street Space within the Scope of the Noise Reduction Planning**

Borough	Exemplary roads
Mitte	Prinzenallee from Pankstraße to Osloer Straße Drontheimer Straße from Osloer Straße to Ritterlandstraße
Friedrichshain-Kreuzberg	Dudenstraße from Mehringdamm to Bezirksgrenze
Charlottenburg-Wilmersdorf	Brandenburgische Straße from Berliner Straße to Hohenzollerndamm

■ **Map 1 Concept Areas and Roads as well as Exemplary Roads**

2.2 Chronological Differentiation of the Noise Action Plan

The measures for noise reduction developed are differentiated into measures to be implemented in the

- short term (Stage 1) and medium and
- long-term options for measures (Stage 2)

An implementation of stage 1 measures has already begun, the objective is to implement all in the period between 2008 and 2012. To be able to do this, necessary planning and coordination procedures have to be continued and financial funds have to be ensured. The implementation of the measures for street design of the 4 exemplary roads is a central issue of the short-term measures in addition to the measures that are already being planned. The noise reducing effect of road design measures in these exemplary roads is to be demonstrated, and the possibility to implement the recommended measures should be tested taking into account traffic concerns².

Medium- and long-term measure options that could not be definitely clarified within this noise action plan should be examined. Furthermore some of these options for measures should be examined and detailed later on with the help of knowledge gained by pending experiences:

- Measures to avoid traffic are closely linked to questions of overall and local urban and traffic development. They are often related in complex interdependencies with which the concepts for overall noise action plans and the noise action plan for the concept areas cannot deal. They have to be solved by overall urban and local planning, especially within the updated StEP Traffic³ and in local traffic and land-use concepts.
- The installation of 30 km/h speed zone regulations is a very effective and efficient means to reduce noise exposure. With the currently implemented extensive regulations for max. 30 km/h speed regulations at night a substantial reduction of noise exposure can be attained. Speed 30km/h regulations change the quality of passenger car traffic though. A considerable number of sections of the major traffic road net are concerned (a total of approx. 50 km); it is therefore necessary to examine the impact of these measures on traffic. Further tests regarding the establishment of speed 30 road sections in the concept areas are recommended

² E.g. traffic security, road coverage, the importance of street space for land use, the interests of public transport and general technical (e.g. issues of the administration of cable and other lines) and legal traffic interests.

³ Senate Administration for Urban Development, Urban Development Plan StEP Traffic, Berlin 2003

as medium- and long-term measure options. They should be continued, when more experience with the implementation of speed 30 at night has been gained.

- Before detailing and preparing the implementation of substantial recommendations regarding street design measures the necessary steps, based on the short-term implementation of the four exemplary road sections should be clarified, the gained experiences regarding the effects on traffic and noise should be taken into account.
- The realization of technical measures for noise reduction in the Berlin railway net (Berliner Hochbahn)) (such as noise protection brims or track absorbers) need a closer further examination regarding their actual applicability and effectiveness. This shall follow within pilot projects that will be referred to later on.

2.3 Handbook Noise Action Plan

This Noise Action Plan should be used as a handbook, it comprises

- General recommendations regarding noise reduction in road traffic (Chapter 5.1 to 5.4),
- A catalogue of short-term measures to be implemented in the concept areas (Chapter 5.6: Catalogue of measures for noise reduction in motor car traffic),
- Exemplary description of the necessary steps to implement noise reducing street design measures for (Chapter 5.7: Planning measures for exemplary road sections),
- Considerations regarding passive noise protection measures (Chapter 5.8),
- General recommendations and concrete measures regarding local railway traffic (Chapter 6)
- Statements about further noise sources (aircraft and rail traffic, Chapter 7) and
- The definition of quiet areas and considerations about possible protection measures (Chapter 8)

These are preceded by the summarized results of the conducted analysis and the existing plans and their effects on noise.

The description of different levels of specification (from basic approaches to concrete measures for first steps to prepare implementation) allows the use of the noise action plan as a handbook to develop appropriate noise reducing measures. And also other planning authorities should be able to consider noise reduction measures with help of the noise action plan.

Materials regarding the Noise Action Plan

The developed materials regarding the concept areas and the concept road sections as well as the detailed surveys regarding the exemplary road sections are available as "Materials for the Noise Action Plan".

A detailed documentation of individual work steps (such as measures for local railways) is also available within the "Materials of the Noise Action Plan".

Chapter 11 includes a final list of subjects for which further materials are available.

3 Summary of the Analysis of the Noise Exposure Situation

The Action Plan for noise reduction is based on the strategic noise map and the traffic noise map for the major roads net 2005.

The strategic noise map is based the requirements of the European Environmental Noise Directive. For the community wide common evaluation of noise levels the following noise indicators have been established

- Lden (Day-Evening-Night noise indicator) to asses annoyance
- Lnight (Night noise indicator) to assess sleep disturbances

The major net roads traffic noise map 2005, showing passenger car and streetcar traffic noise exposure during a day and a night for the nearby buildings⁴, is based on the national calculation rules of RLS 90⁵ and from Schall⁶

3.1 Noise Mapping Results

Within the Strategic Noise Mapping⁷, commissioned by the Senate Administration for Public Health, Social Services and Consumer Protection, completed in September 2007, the following relevant noise sources

- Road traffic
- Streetcar and subway traffic
- Industrial noise
- Aircraft traffic noise and
- Railway traffic noise

Noise propagation and the people affected were assessed according to the respective methods differentiated by level classes for each of the different noise sources⁸.

The following tables show the results of the strategic noise mapping and allow data comparison for the different noise sources

- **Table 3 People Affected by Road Traffic Noise in their homes, (related to the Noise indicator LDEN and the Noise Indicator LNIGHT)**

Level Range LDEN in dB (A)	>55 to 60	>60 to 65	> 65 to 70	> 70 to 75	> 75
Number of Persons	220.220	155.000	140.200	112.600	20.800

Level Range LNIGHT in dB (A)	>50 to 55	>55 to 60	> 60 to 65	> 65 to 70	> 70
Number of Persons	183.800	146.400	135.300	56.300	1.400

⁴ see also www.stadtentwicklung.berlin.de/umwelt/umweltatlas/ia702.htm

⁵ The German Federal Ministry of Transport, Road Construction Department, Directives for noise protection on roads, RLS-90, 1990

⁶ Deutsche Bundesbahn, Directive for the Assessment of Noise Emissions of Railways, Schall 03, Edition 1990

⁷ The Strategic Noise Mapping was commissioned according to the requirements for Noise Mappings of the Ordinance for Noise Mapping (34.BImSchV) in connection with §§47a-f BImSchG and the Directive 2002/49/EG (Environmental Noise Directive) as well as under consideration of the current LAI-Precriptions (Federation/Land Commissions for Emmission Protection) and was executed by the Arbeitsgemeinschaft Lärmkartierung Berlin GbR.

⁸ See also: <http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/i705.htm>

- **Table 4 People affected by Road and Underground railway noise in their homes (related to the Noise Indicator LDEN and the Noise Indicator LNIGHT)**

Level Range LDEN in dB (A)	>55 to 60	>60 to 65	> 65 to 70	> 70 to 75	> 75
Number of Persons	38.000	25.700	11.600	1.400	0

Level Range LNight in dB (A)	>50 to 55	>55 to 60	> 60 to 65	> 65 to 70	> 70
Number of Persons	31.400	16.600	6.300	500	0

- **Table 5 People affected by Industry Noise in their homes (related to the Noise Index LDEN and the Noise Index LNIGHT)⁹**

Level Range LDEN in dB (A)	>55 to 60	>60 to 65	> 65 to 70	> 70 to 75	> 75
Number of Persons	200	100	100	0	0

Level Range LNight in dB (A)	>50 to 55	>55 to 60	> 60 to 65	> 65 to 70	> 70
Number of Persons	100	100	0	0	0

- **Table 6 People affected by aircraft noise in their homes (related to of the Noise Index LDEN as and the Noise Index LNIGHT)**

Level Range LDEN in dB (A)	>55 to 60	>60 to 65	> 65 to 70	> 70 to 75	> 75
Number of Persons	133.100	96.600	20.100	1.500	0

Level Range LNight in dB (A)	>50 to 55	>55 to 60	> 60 to 65	> 65 to 70	> 70
Number of Persons	61.400	12.000	600	0	0

- **Table 7 People affected by railway noise in their homes (related to the Noise Index LDEN and the Noise Index LNIGHT)**

Level Range LDEN in dB (A)	>55 to 60	>60 to 65	> 65 to 70	> 70 to 75	> 75
Number of Persons	104.600	42.200	17.200	5.100	800

Level Range LNight in dB (A)	>50 to 55	>55 to 60	> 60 to 65	> 65 to 70	> 70
Number of Persons	77.900	31.800	10.300	2.600	400

For the road traffic and railway traffic as major noise sources the results of the strategic noise mapping are shown in exemplarily in the maps 2 to 4

- **Map 2 Strategic Noise Map L(den) Road Traffic 2005**
- **Map 3 Strategic Noise Map L (night) Road Traffic 2005**
- **Map 4 Strategic Noise Map L(night) Railway traffic 2006**

⁹ The number of persons affected are due to a noise protection construction that doesn't work satisfactorily; A renewal of the construction was scheduled for the Year of the Survey (2005)

3.2 Limit Values for the Noise Reduction Plan

The European Environmental Noise Directive and the Federal Immission Control Act do not give limit values to be able to assess appropriate Noise Reduction measures. The evaluation of the people affected is given by limit values related to health, resulting from noise impact research (among others by the Federal Environmental Office). According to noise impact research the risk of cardiovascular diseases generated by chronic noise stress¹⁰ increases as from a long-term exposure of 55 dB (A) at night and 65 dB (A) at day. The compliance with these values is the medium-term objective.

Because in Berlin many roads exceed these values, it is first necessary to concentrate on the very high noise exposures (> 70 dB (A) at day and 60 dB (A) at night).

Two stages with limit values related to the urgency for measures are established in the Noise Reduction Plan for Berlin:

- 1st Stage: 70 dB (A) day and 60 dB (A) night – when these values are exceeded short term measures have to be taken with priority to reduce health risk
- 2nd Stage: 65 dB (A) daytime and 55 dB (A) night – these values are established by noise impact research as health relevant limit values and serve as target values for prevention in noise reduction planning

3.3 Impact According to Noise Sources

According to the evidence given by the Strategic Noise Mapping (see Tables 3-7) 193.000 persons are affected by road traffic noise with night values of the 1st stage with 60dB(A).

Railway noise also has a high level of impact, especially at night (13.300 persons with values >60 dB (A))

Most of the 6.800 persons affected during the night by streetcar and above-ground subway noise with levels higher than 60 dB (A), are also affected by road traffic noise.

The impact from aircraft noise is considerably lower¹¹, industrial noise does not show noise exposures higher than 60 dB (A) at night.

The comparison of the number of persons affected makes shows that road traffic is the predominant cause of noise exposure and the necessity for action against this noise source.

An inquest in the boroughs regarding existing noise conflicts has evidenced that passenger car traffic and freight traffic are the major sources of conflict. In areas with local railways (streetcars and above-ground subway), these are also critical regarding noise.

In some boroughs conflicts with aircraft traffic and railway traffic are mentioned.

The measures developed will be based fundamentally on detailed analysis of road traffic noise as the major generator of noise exposure, partly including streetcar and above-ground subway traffic noise in the road space.

¹⁰ See special expertise of the Council of Experts on Environmental Matters, Drucksache (Bundestag paper) 14/2300, 14th Legislative Period on 12/15/99

¹¹ Mapping included Tegel Airport

3.4 Detailed Analysis of Passenger car Traffic and Local Railway Traffic

The detailed analysis is based on the traffic noise map “Major Net Roads 2005” that shows noise exposure from passenger car traffic and streetcar traffic in the neighbouring built up areas¹².

The Major Net Roads Traffic Noise Map 2005 updates the noise map made continuously in Berlin since 1992 with inclusion of the current traffic census of 2005.

The results of the strategic noise mapping can be compared with the traffic noise map in respect of passenger car traffic. The results regarding streetcar and above-ground subway traffic can show deviations because of different data base and evaluation regulations¹³.

The Traffic Noise Map Major Net Roads 2005 is more adequate as a planning instrument for the evaluation and the development of measures than the strategic noise map, because the survey of individual road sections is relatively easy to calculate. The advantage of the strategic noise maps lies in the detailed consideration of noise levels on façades for each building. For the noise reduction planning, inasmuch as measures for road sections can be developed from them, they are not practical.

The Noise Exposure Situation in the Surveyed Net

The detailed analysis of the noise disturbance situation allows to establish the central problems (Hot Spots of noise exposure) and the major operation fields for Noise Action Planning. The noise analyses are made for approx. 1.300 km. The Berlin road net totals 5.140 km. The major traffic roads and all roads with an allowed speed of max. 50 km/h in the city centre as well as the total streetcar net (surveyed net) are taken into consideration. The above-ground subway traffic noise will also be taken into account.

■ Table 8 Berlin overall – Noise Pollutions (medium overall level near buildings day and night per km built street side), Analysis 2005

Noise Immissions dB(A)-	Day			Night		
	km Road Side	%	% accumulated	km Road Side	%	% accumulated
at 50	23,976	1,0	100,0	197,376	8,5	100,0
> 50 - 55	104,013	4,5	99,0	387,984	16,7	91,5
> 55 - 60	287,352	12,3	94,5	750,783	32,2	74,9
> 60 - 65	686,529	29,5	82,2	795,477	34,1	42,6
> 65 - 70	890,660	38,2	52,7	185,582	8,0	8,5
> 70 - 75	316,439	13,6	14,5	12,255	0,5	0,5
> 75 - 80	19,827	0,9	0,9	0,000	0,0	0,0
> 80	0,661	0,0	0,0	0,000	0,0	0,0
Total	2329,457	100,0		2329,457	100,0	

In the surveyed road net of the Major Net Roads Traffic Noise Map 2005 the limit values of the 1st stage during daytime are exceeded by approx. 15% on the total length of the surveyed net, at night by more than 40%. This shows a strong need for action especially to improve night values.

The limit values of the 2nd stage are exceeded on more than 50% of the total length of the surveyed net, at night on three quarters of the net.

¹² See also www.stadtentwicklung.berlin.de/umwelt/umweltatlas/ia702.htm

¹³ see also Chapter 6

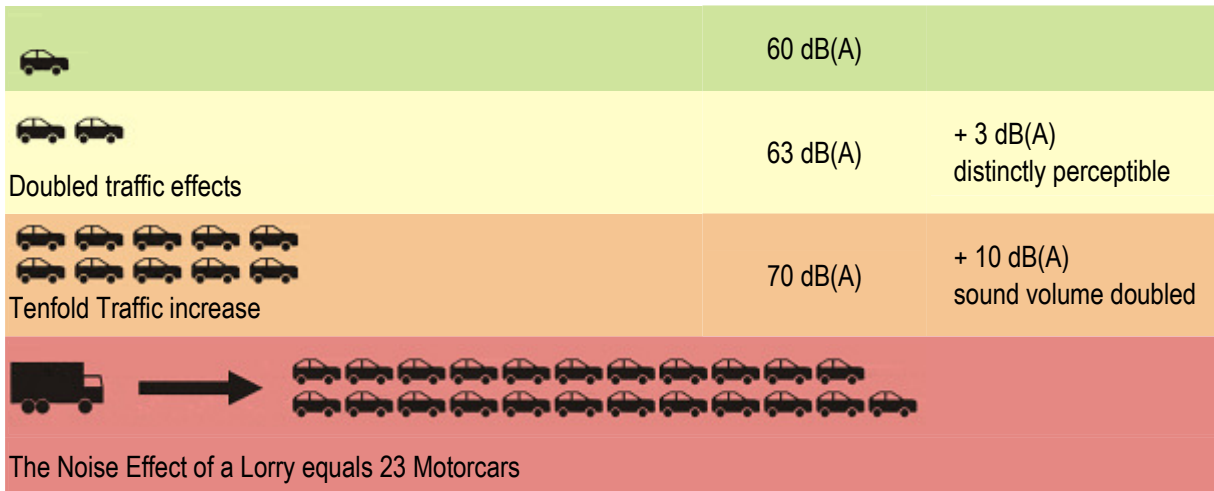
- **Map 5 Medium level according to limit values, Daytime, by the roadside buildings, on the noisiest road side, Passenger car and Streetcar traffic noise, Analysis 2005**
- **Map 6 Medium level according to limit values, Night, by the roadside buildings, on the noisiest road side, Passenger car and Streetcar traffic noise, Analysis 2005**

Analysis of the Pollutions

Passenger car traffic is the major generator of noise exposures. The amounts of the passenger car exposures are the crucial factor. The amount of noise pollutions depends furthermore on the general urban framing.

- In road spaces with distances between buildings smaller than 20 m, traffic noise created by less than 10.000 vehicles/24 h are sufficient to create noise exposures higher than the limit values of the 1st Stage: (70dB(A) at daytime, 60 dB (A) at night).
- In road spaces with distances between buildings smaller than 30 m, traffic noise created by less than 20.000 vehicles/24h can exceed the limit values of the 1st stage
- Very high traffic effects of more than 50.000 vehicles/24h create noise values higher than the 1st limit value in large road spaces with distances between buildings of more than 50 m.
- The maximum traffic effects are created on the BAB A 100 autobahn with 190.000 vehicles/24h – noise values above the limit values of the 1st stage are attained even with great distances to the buildings.

■ Illustration 1 Interrelation between Traffic Volume, Proportion of Lorry Traffic and Average Value

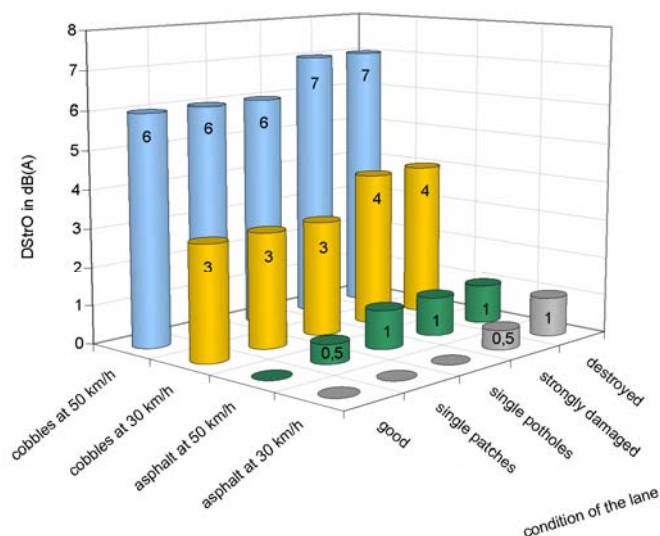


In some roads freight traffic, disadvantageous street surfaces or streetcars create an important proportion of noise exposure.

Approximately an eighth of the surveyed net has a percentage of freight traffic of more than 5%. A percentage of 5% freight traffic equals the traffic exposure of total passenger car traffic .

Paved surfaces increase the noise on the lane. The surveyed net includes approx. 2%. Approx. 10% of the surveyed roads has damaged asphalt surfaces, which also contribute to higher noise disturbances.

■ **Illustration 2: Surcharges for lane surfaces and the condition of lanes in relationship to speed**



- Streetcars operate on approx. 190 km compared with the 1300 m long surveyed net (=15%). On 4% of the segments of the surveyed net the streetcar is so noisy, that it increases noise in addition to road traffic and only on 1% the streetcar is noisier than passenger car traffic.
- The length of the above-ground subway trains is 26,3 km. Conflicts generated by above-ground subway traffic have a length of approx. 3,4 km (=0,3% of the surveyed net).

Analysis of persons affected in the surveyed net

A Noise Indicator (LärmKennZiffer (LKZ)) describes the effects created by noise exposure in a road. It combines the noise exposures in the road with the number of people affected. The assessed noise indicator is a product of exceeding a limit value of noise disturbances and the people affected, it is high in places where high residential density and high noise level come together.

LKZ = Persons Affected (Average value-Limit value)/100 m Road length

The health relevant values of 65 dB (A) at daytime and 55 dB (A) at night are used as limit values

■ **Table 9 Berlin overall – Noise indicator (LKZ) 65 dB (A) Daytime/55 dB (A) Night, Analysis 2005**

LKZ	Day (> 65 dB(A))			Night (> 55 dB(A))		
	Number of Sections	%	% accumulated	Number of Sections	%	% accumulated
0	3711	48,2	100,0	2403	31,2	100,0
< 50	1500	19,5	51,8	1566	20,4	68,8
50 < 100	528	6,9	32,3	565	7,3	48,4
100 < 250	964	12,5	25,4	1085	14,1	41,1
250 < 500	686	8,9	12,9	1129	14,7	27,0
500 < 1000	301	3,9	4,0	816	10,6	12,3
1000 < 1500	5	0,1	0,1	126	1,6	1,7
=> 1500	0	0,0	0,0	5	0,1	0,1
Total	7695	100,0		7695	100,0	

■ **Table 10 Berlin overall - Noise Indicator 70 dB(A) Daytime / 60 dB(A) Night, Analysis 2005**

LKZ	Day (> 70 dB(A))			Night (> 60 dB(A))		
	Number of Sections	%	% accumulated	Number of Sections	%	% accumulated
0	6538	85,0	100,0	4395	57,1	100,0
< 50	554	7,2	15,0	1318	17,1	42,9
50 < 100	233	3,0	7,8	473	6,1	25,8
100 < 250	285	3,7	4,8	835	10,9	19,6
250 < 500	81	1,1	1,1	530	6,9	8,8
500 < 1000	4	0,1	0,1	143	1,9	1,9
1000 < 1500	0	0,0	0,0	1	0,0	0,0
=> 1500	0	0,0	0,0	0	0,0	0,0
Total	7695	100,0		7695	100,0	

the centres of noise exposures for which mitigation measures are conceived within the noise action plan are defined by the level of the noise indicator (LKZ), i.e. noise reduction measures are to be taken with priority in those places where a great number of people are affected by high noise exposures. The established Hot Spot net includes all road sections with a LKZ for the night, based on 55 dB (A) equal or higher than 250.

The Hot Spot survey net includes 2.076 road stretches (= 27% of the surveyed net) with a total length of 310 km.

■ **Map 7 Analysis of the Hot Spot Survey Net**

System of Quality Indicators

Detailed analysis are made in the hot spot survey net for noise reduction. One of the objectives is to assess subjective aspects of noise perception. For instance, noise exposure is perceived as less negative in a well-designed street space than in a street space that is felt as unpleasant.

On the other hand, loud roads often have further deficiencies, such as a high grade of air pollution or unfavourable conditions for traffic modes of the environment network (pedestrian and bicycle traffic or public transport). This shall be taken into account for the development of measures.

For the concerted evaluation of the different aspects, a system of quality indicators was developed, that combines different goal systems. The results show the fields in which the greatest deficiencies exist and therefore call urgently for measures.

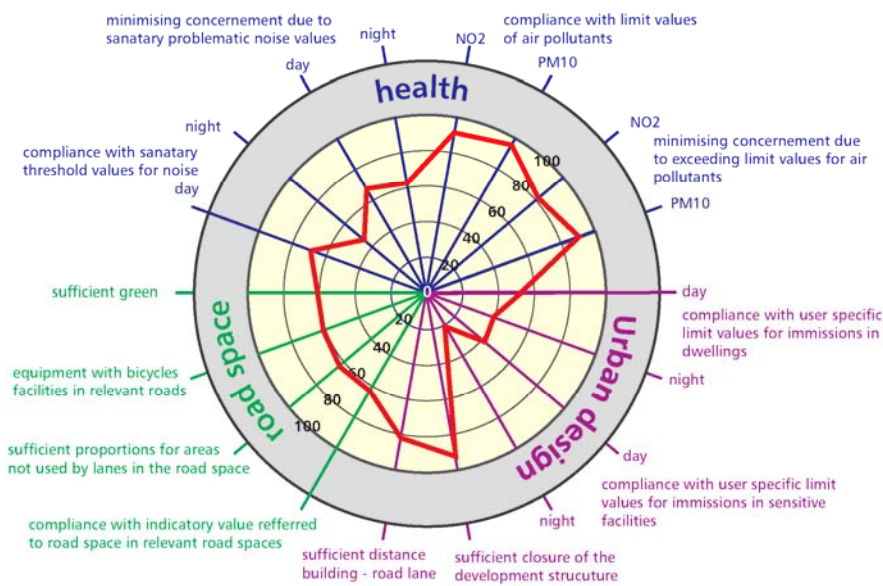
The evaluated target fields are:

- Health – healthy living conditions
- Urban qualities – quiet town
- Special road qualities – silent and agreeable traffic design

Indicators are attributed to target fields that are evaluated according to the situation in the survey net. The target values and the evaluation attached with them are deduced from the aspired minimising of the exposures and from target values, e.g. for street space design.

The results are represented in so called target spiders (Zielspinnen) either for the whole town or for segments.

■ Illustration 3 “Zielspinne” “Goal spider” quality indicators system, analysis of all Hot Spot sectors



The evaluation for each target field in the overall Hot Spot net is shown in the “Target Spider” for the quality indicator system. The higher the level of target attainment lies on the scale from the centre to the periphery, the better this area is evaluated.

The evaluations of noise in the **target field “health”** are already described in the noise analysis.

Health risks created by exceeding the limit values of air pollution are less degree that those generated by noise exposure.

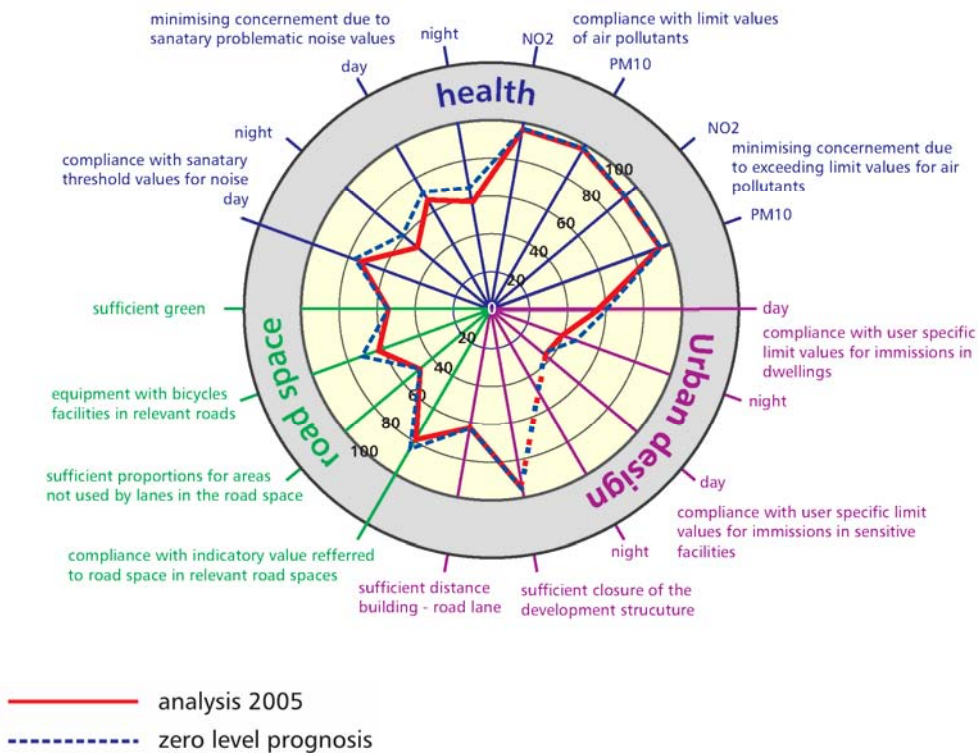
In the **target field “urban design”** the levels of target attainment are low for pollution limit values related to specific users. In sensitive institutions and at night (e.g. Hospitals) the evaluations are extremely unfavourable. The evaluation of the urban development context shows good target achievement levels. Nevertheless there are centres with need for action, especially in areas with too short spaces between the road lanes and the buildings.

In all evaluations of the **“target field road space”** there is need for action for diverse spaces. The noise guideline for road space is often exceeded in important, strongly frequented roads with a high noise exposure (e.g. Potsdamer Strasse, Berliner Allee). In densely built town quarters with narrow roads (e.g. Boxhagen Quarter) and also in the highly equipped major radial roads (e.g. Heerstrasse) there are often deficiencies in the road layout. The evaluations of road spaces also show that approx. 40% of the surveyed net lacks bicycle paths.

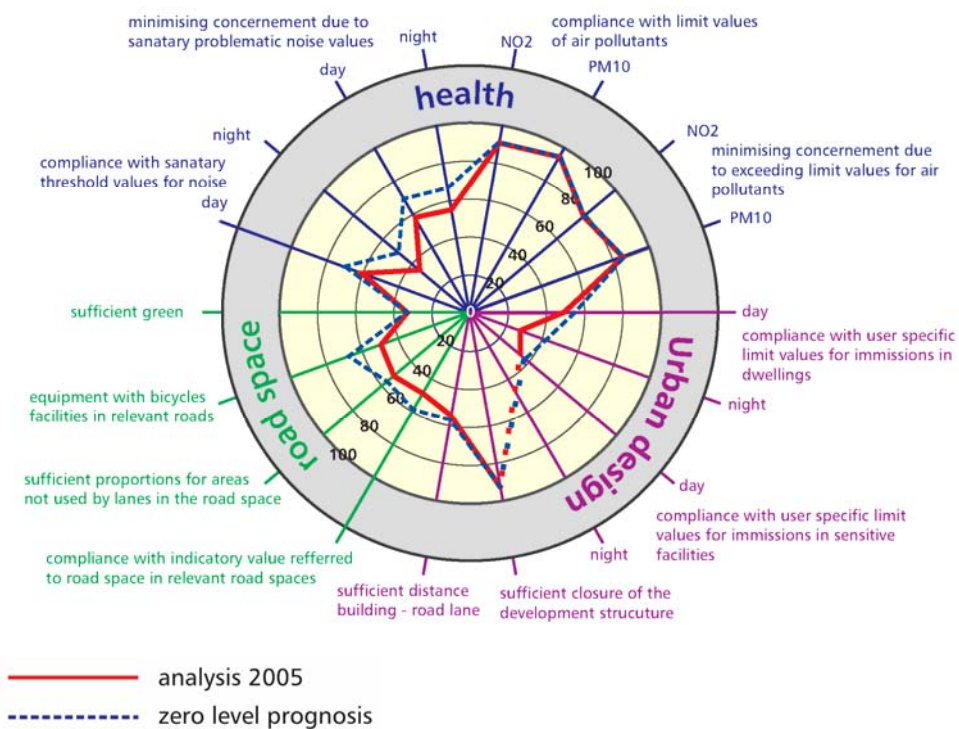
Similar action fields, described together in the “goal spider” show the broader approach of the noise reducing measures and their effect. Noise reducing measures have synergy effects on neighbouring action fields. These can be mapped in the before-after comparison of the target spider.

The evaluation of costs, i.e. cost-benefit-effects has to take into account these synergy effects.

- **Illustration 4: Before-After Comparison of the “Target Spider”(Zielspinne) -Quality Indicator System for zero level prognosis (see Chapter 4). Exemplary Concept Area Boxhagen Quarter**



- **Illustration 5: Before-After Comparison of the “Target Spider” (Zielspinne) Quality Indicator System for Zero Level Prognosis (see Chapter 4) of the Concept Area Ober- and Niederschönweide**



4 Existing Plans and their Noise Relevance

The subject of noise has already been dealt with in existing planning. Planning also has affects traffic and frequently also noise exposure. The Noise Action Plan must integrate existing planning and can eventually take advantage of its effects. Therefore urban development and urban planning concepts and projects as well as traffic planning (Urban Development Plan for Traffic)¹⁴ and environmental planning are relevant (Clean Air Plan).

- The Urban Development Plan aiming at inner city development and an urban concentration in local centres is suited to avoid further increasing traffic and noise exposure traffic.
- The Urban Development Plan for Traffic and detailed plans have the objective to design qualified urban spaces for traffic and thus contribute to reduce traffic and noise.

There are also concrete noise reduction plans for the existing pilot areas in the boroughs of Charlottenburg, Köpenick, Mitte (Centre) and Pankow.

The effects of existing planning on noise exposure are displayed in the Zero Level Prognosis Noise Reduction that shows the expected development of noise levels, taking the exposures described in the Analysis 2005 and no measures of the Noise Action Plan¹⁵ as a point of reference.

This Zero Level Prognosis takes into account scheduled infrastructural measures and measures regarding traffic management to be implemented during the period of validity of the Noise Action Plan, i.e. 2015.

These are primarily

- The construction, the expansion and the renovation measures in the road net, that will affect the distribution of traffic within the net,
- Renewal measures on roads and streetcar tracks and
- The Speed 30 at night concept of the Senate Administration for Urban Development

Measures influencing the configuration of traffic and modal-split in a complex relationship (e.g. parking area management, bicycle traffic strategies ...) cannot be accounted for as to their quantitative effect on traffic in this Level Zero Prognosis for Noise Reduction. The fundamental effects of these measures are described in the StEP Verkehr (Traffic) and are displayed in the Traffic Model 2005.

The quantifiable effects of the existing plans are summarised and evaluated in respect to their effect on noise. The following modifications of the Analysis 2005 with the forecast horizon 2015 are taken into account for the calculations:

- Traffic volume of the Zero-Level Prognosis Noise Reduction,
- Road lane surfaces subject to surface renewals (Anti-road hole program) and number of traffic lanes
- Maximum speeds after implementation of the Speed 30 concept at night
- Types of streetcar tracks after the implementation of the Streetcar noise renewal program

¹⁴ Senate Administration for Urban Development, Urban Development Plan StEP Verkehr (Traffic) , Berlin 2003

¹⁵ the effects of the recommended measures of the Noise Action Plan will be displayed in a planning case Noise reduction

■ **Table 11 Berlin total - Noise pollutions (Average Total Level Evaluation Close to buildings Day and Night per km built road side) Zero Level Prognosis**

Noise Immissions dB(A)-	day			night		
	km Road Side	%	% accumulated	km Road Side	%	% accumulated
at 50	26,998	1,2	100,0	210,253	9,0	100,0
> 50 - 55	110,849	4,8	98,8	415,320	17,9	91,0
> 55 - 60	310,544	13,4	94,1	795,761	34,2	73,1
> 60 - 65	693,624	29,8	80,7	752,929	32,4	38,9
> 65 - 70	879,192	37,8	50,9	139,532	6,0	6,5
> 70 - 75	287,342	12,4	13,1	11,919	0,5	0,5
> 75 - 80	16,772	0,7	0,7	0,000	0,0	0,0
> 80	0,392	0,0	0,0	0,000	0,0	0,0
Summe	2325,713	100,0		2325,713	100,0	

Compared to the Analysis 2005 the Zero-Level-Noise Reduction Forecast can achieve the following improvements:

- 89 km heavily exposed road sections (with noise values higher than the 1st limit value (60 dB (A)) can be improved at night. The percentage of these highly exposed sections drops from 43% to 39%.
- During the day a proportion of 32 km highly exposed segments (above the 1st limit value 70 dB (A)) can be relieved. This is equivalent to a reduction from 15% to 13% on all sections.
- In 73% of the road sections the limit value of the 2nd stage at night (55 dB (A)) will be exceeded in the Zero-Level-Noise Reduction Prognosis compared to 75% in the Analysis 2005
- In 51% of the built road segments the limit value of the 2nd stage for the day (65 dB (A)) will be exceeded in the Zero-Level-Noise Reduction Prognosis compared to 53% in the Analysis 2005.

The assessed effect of the measures in the zero level prognosis shows that a reduction can lead to definite local improvements, even if it does not show in the overall statistics. The exposure peaks can be partially cut down by existing planning and planning being implemented.

The calculation of the effects of the level zero prognosis show further need for action. In almost 40% of the road net there is still a noise level of > 60dB(A).

- **Map 8: Difference Noise Map Analysis 2005 / Prognosis-Zero-Case**

5 Noise Reducing Strategies and Concepts for Passenger car Traffic

Based upon the analysis of the effect of existing planning and the need for action and traffic analysis, strategies and master concepts are developed for the whole town.

The overall urban noise reducing framework concepts are based upon the following action strategies

- Avoidance of noise pollutions
- Relocation of noise pollutions
- Reduction of noise pollutions and
- Reduction of noise immisions

The avoidance of noise pollutions is focussed on a super ordinate strategy to reduce pollutions in traffic by encouraging low-noise traffic modes and measures containing noisy passenger car and freight traffic.

The relocation of noise pollutions pursues the strategic approach to bundle the exposures and/or to relocate them from highly sensitive to less sensitive areas, if no other issues e.g. air pollution, are concerned unfavourably.

The reduction of noise pollutions is rather focussed on local objectives to handle traffic more quietly and urbanely.

The reduction of noise immisions focuses on the propagation path to reduce the noise exposure on noise-sensitive areas or in buildings.

Concept modules to analyse the feasibility and the reducing potentials of individual fields for activity are developed to implement individual strategic actions.

We are working with:

- Urban Development concept modules
- Traffic Development concept modules
- Road Net Design and Traffic Control concept modules
- Traffic Management and Road Space concept modules for
- Passive Noise Protection concept modules for

The importance of each noise reducing planning concept module will be described as follows. In each concept area and concept road section the local level will be described in detail

5.1 Urban Development Concept Modules

The urban development concept modules are closely linked with existing planning and give recommendations on how to take into account noise reducing aspects and requirements.

Urban development and land use planning as well as several other informal plans monitor the spatial development and the urban design of Berlin. Subjects such as density of uses allocation of uses, accessibility and traffic flows resulting from these interact with noise reduction.

The strengthening of the development of the city centre and of the polycentric configuration of Berlin, envisaged by Berlin urban development planning, is favourable for an environmentally compatible handling of traffic, especially in the cases where the focuses for development lie in areas well accessible by railway traffic. This is also positive for noise reduction.

An increase of the density of uses especially in those highly exposed inner city areas bears the risk to create higher exposure and a higher number of affected persons.

To avoid this, interrelated and interdependent strategies already being pursued by existing planning in Berlin are significant:

- An urban development and land-use planning that with the strategy of inner-city development and mixed uses contributes to the fact that at least the overall traffic performance does not grow further
- A traffic development planning that contributes to avoid passenger car traffic and handle the necessary traffic in the town in an environmentally friendly way, at the same time relieving the highly used inner city areas

Beyond this, for existing land uses and in land-use planning there are noise reducing and handling requirements and relevant approaches.

Against this background the following urban development and urban planning concept modules within the noise action plan are important:

- Considerations regarding low-noise urban development
- Considerations to observe aspects of the noise reducing planning for urban design objectives
- Help for location decisions as seen by noise reducing planning.

5.1.1 Considerations for a Low-Noise Urban Development

On the level of land use planning, according to § 50 BImSchG¹⁶ the allocation of land uses (including traffic uses) in a compatible way and approaches to develop traffic avoiding structures ("short ways in town"), are important to handle noisy structures.

In the most important noise focuses within the existing urban structures of Berlin, a separation of uses (larger distances between each use) in most of the cases is impossible and it contradicts the envisaged mixing of uses.

Combined with existing urban development objectives, the following strategies for a low-noise urban development shall be pursued:

¹⁶ spacial planning and spacial measures have to allocate areas for a determine use in such a way that harmful environmental effects on areas used exclusively or predominantly for residential purposes or on other protected areas are avoided

- A further improvement of the general and particular mixing of uses by appropriate allocation of uses//land use decisions to avoid an increase of total traffic activities
- A further inner city development especially on locations with an excellent accessibility by the traffic modes of the environmental network to avoid an increase of passenger car traffic
- Allocation of uses and choice of locations for noisy uses, under consideration of existing and new traffic and environmental exposures (see also Chapter 5.1.3). The disturbances created by freight traffic are to be especially considered from the point of view of noise.
- Allocation of uses and choice of locations for uses that are noise-sensitive, considering the existing environmental disturbances and further constraints. This means that especially with envisaged residential areas, acoustic exposure limits have to be defined and the possibilities to develop an insensitive urban structure have to be evaluated (see also Chapter 5.1.2)

5.1.2 Aspects of the Noise Reducing Planning for Urban Planning Objectives

To comply with the objective of a “low-noise town” measured against the limit values of DIN 18005 (Noise protection in urban design) would often mean that residential uses are not possible on major access roads. Therefore it is necessary to harmonise the objective to create healthy living conditions by avoiding and minimising detrimental noise effects with the goal to mix uses and develop the inner city.

An approach to a solution could be the development of appropriate urban structures that include requirements for noise insensitivity.

Noise insensitivity means:

- In a narrower sense, an urban structure able to deal with exposure on the exposed sides and that creates quiet, noise-shielded areas,
- In a wider sense urban structures, that due to their overall qualities can compensate up to a certain grade noise exposure and that are attractive even if exposed to noise

Noise insensitivity in a narrower sense requires especially

- To take into account noise exposure for the design and the dimensioning of road spaces
- An high quality urban design concept and quiet areas turned away from the major traffic roads

Further criteria was developed for noise insensitivity in a wider sense in the ExWoSt-Expertise “Lärmrelevanz und EU-Anforderungen” (Relevance to Noise and EU-Requirements)¹⁷. They include aspects of buildings and areas and allow a holistic urban-acoustic evaluation. This includes among others the attractiveness of uses (Shops, Services, Cafés), the equipment with open spaces and the accessibility of green areas for recreation, the centrality of the town quarter as well as its image.

Even if issues regarding urban design goals do not automatically generate direct measures for noise reduction, they are still of relevance because they allow a strategic handling with existing noise exposure situations required by the EU. The issues must be integrated into the corresponding planning processes. This applies for urban design concepts for new town quarters as well as urban renewal plans for town areas exposed to noise.

Objectives for noise reduction can be implemented or supported within detailed land use plans. The following stipulations with potential effects on noise reduction can be relevant¹⁸:

- The character of the buildings' uses combined with the grouping of building areas, the exclusion of uses as well as the stipulation of uses for determined storeys and levels
- The intensity of use of the buildings together with the number of storeys and the height of the buildings
- The type of construction (if detached, compact or deviant types of buildings)
- Areas to be built upon on the plot determined by their possible limits, their firmly stipulated limits or a marked area, within which a building can be erected and
- The position of the buildings (§9 Art. 1 Nr. 1 BauGB – Federal Building Code).

The Handbook of the Federal Environmental Office “PULS – Praxisorientierter Umgang mit Lärm in der räumlichen Planung und Städtebau” (Practical handling of noise in spatial planning and urban design)¹⁹ gives an outline for noise reducing measures in each planning stage (new planning and developing of existing structures).

¹⁷ Planungsgemeinschaft Dr.-Ing Waltehr Theine (PGT) by commission of the BBR, Lärmrelevanz und EU-Anforderungen – Requirements, Limitations and Adjustment Processes to Noise protection, information about the expertise see also www.bbr.bund.de/nn_21890/DE/forschungsprogramme/ExperimentellerWohnungsstaedtebau/Studien/Laermrelevanz/01_Start.html

¹⁸ These possible stipulations are described for the detailed land use plan in the report for the Mierendorffinsel (Mierendorff Island)

¹⁹ Lärmkontor/BPW/konsalt by order of the Federal Environmental Department, “PULS – Praxisorientierter Umgang mit Lärm in der räumlichen Planung und Städtebau” (Practical handling of noise in spatial planning and urban design)

5.1.3 Decision Helps for the Location of Uses for Noise Reduction Purposes

The Senate Administration for Urban Development edited a compendium of work tools with criteria and test questions named „Leitfaden zur verkehrlichen Standortbeurteilung und Verkehrsfolgenabschätzung für verkehrsintensive Vorhaben“²⁰ “A guideline to evaluate traffic locations and to assess the effect on traffic of buildings with high traffic requirements” with which the traffic associated with a building can be assessed and optimized at an early stage. The objective is to minimize the conflicts produced by additional traffic.

Noise exposure is regarded as a criterion:

- Within the quality evaluation of the fundamental adequacy of the location (Level 1) judging by the average noise level during the day²¹ in the adjoining road net a categorization as not critical (<60 dB (A)), possibly critical (> 60 – 65 dB (A)) and critical >65 dB (A) is made.
- Within a necessary evaluation of the consequences the building will have on traffic of (Stage 2) the noise exposure generated by traffic has to be proved by calculations according to RLS-90. Eventually it is necessary to develop and describe improving measures.

From the point of view of the Noise Action Plan an early assessment of the noise exposure is relevant to evaluate the location of a building with a high traffic demand, so as to avoid additional incompatible noise disturbances.

We propose to integrate the aspects elaborated in the Noise Action Planning to assess noise exposure, especially Stage 2. We estimate that the following criteria should be applied:

- *People affected by noise exposure:*
People affected according to the noise indicator (LKZ) to evaluate noise exposure. Special high requirements should be applied for the selected Hot Spots.
- *The issues of the system of quality indicators*
Criteria of the system of quality indicators for the integral evaluation of noise exposure should be applied, e.g. structure of built up areas, the road space dimensions²².
- *Protection of quiet areas*
The quiet areas and recreational areas established within the Noise Action Plan should be protected and further noise exposures avoided

²⁰ www.stadtentwicklung.berlin.de/verkehr/verkehrsintensive_vorhaben/index.shtml

²¹ from Verkehrslärmkarte Hauptnetzstrassen 2005 (Traffic Noise Map Major Roads Net 2005)

²² The guideline already takes into account further criteria of the system of quality indicators, e.g. facilities for pedestrian and bicycle traffic, air pollution

5.2 Traffic Development Concept Module

Traffic noise can be avoided by using low noise traffic modes. Pedestrians, cyclists and users of public transport generate less noise than passenger car users on daily travels.

Berlin has a substantially lower motorization level (317 passenger cars per 1000 inhabitants) than other agglomerations. This is a good basis for an environmentally oriented mobility. The percentage of 27% of public transport on daily travels is already very high²³.

The “StEP Traffic” has the objective to promote the traffic modes of the environmental network. The increase of passenger car traffic is to be retarded and the percentage of bicycle traffic is to be increased by a combination of measures.

The “StEP Traffic” is being updated regarding its basic assumptions. The 2025 traffic model for Berlin and Brandenburg considers the status quo land-use, population and traffic development.

Traffic measures of the Noise Action Plan are based on the “StEP Traffic”. A great number of measures of the “StEP Traffic” has synergies with noise reduction. All partial strategies present measures that alone or in combination with further measures have positive effects on the development of noise.

The goals of the StEP Traffic are taken over by the Noise Action Plan. To reduce traffic and noise in the Hot spot segments of noise exposure, the noise action plan esteems that the strategies of the “StEP Traffic” to shift passenger car traffic to low noise traffic modes are the most important

- Measures to promote the traffic modes of the environmental network that are related²⁴ to noise reduction planning in many ways
- Conception of parking area management with a step by step expansion to areas with high demand for parking space
- The development of strategy and measure approaches of operational mobility management

The strategies to reduce passenger car traffic and to shift the status-quo passenger car passages towards the environmental network are part of a long-term approach.

The traffic exposure reduction these strategies can attain, allow a perceptible noise reduction only in individual cases within the overall town net, but they have a chance in less busy road nets. They can be implemented for an effective noise reduction, e.g. for low noise design of the road space, a further promotion of traffic modes of the environmental network or for bundled strategies to relieve sensitive areas.

5.2.1 Promotion of the Environmental Network

The “StEP Traffic” offers concepts for measures concerning public transport, pedestrian and bicycle traffic, to shift passenger car passages to environmentally sound traffic modes that have been substantiated in a number of levels²⁵.

²³ Senatsverwaltung für Stadtentwicklung, Mobilität der Stadt – Berliner Verkehr in Zahlen, Ausgabe 2007, Senate Administration for Urban Development, Mobility in the City – Berlin Traffic in Numbers, Edition 2007

²⁴ Manifold meaning here: the general relocation of motorcar traffic to low noise traffic means and redesign of road space to promote low noise traffic means, all of which have a positive effect on noise.

²⁵ Among others in the Local Transport Plan of the Land Berlin 2006-2009 and Bicycle Traffic Strategy for Berlin 2004

The concepts for measures regarding traffic modes of the environmental network show many synergy effects with the Noise Reduction Plan. Parallel to the aimed at a greater mobility with the traffic modes of the environmental network and the reduction of passenger car traffic, concrete road space design measures can improve the conditions for pedestrian and bicycle traffic and thus contribute to noise reduction.

Taking bicycle traffic (potentials for its increase are estimated) as an example, it is possible to show its interrelation with noise reducing planning:

- The bicycle traffic strategy of the Senate Administration for Urban Development ²⁶ aims to increase the proportion of bicycle traffic till 2010 by 50% (from 10 to 15%). The demand for a more environmental traffic in town can be better complied by increasing the proportion of bicycle traffic in the Modal-Split. At the same time the percentage of individual passenger car traffic can be reduced.²⁷ This is an important contribution to noise reduction, even if on the whole town its direct acoustic effects will be relatively small. For some parts of the town (e.g. the inner city) the promotion of bicycles can definitely contribute to reduce noise. Together with other action fields (e.g. parking area management) its potential for noise reducing planning can be increased.
- The installation of bicycle paths in highly exposed roads has direct synergies with noise reduction. On one hand, to increase the distance between the curbs and the buildings has a positive acoustic effect, on the other, the resulting narrowing of the lanes contributes to a steadier and less noisy traffic flow. Often the modified spatial disposition in the road produces a positive noise perception.

Similar interrelationships can be shown for public transport and pedestrian traffic. However bicycle traffic has an overriding importance due to its shifting potentials.

Measures to redesign road space to reduce noise exposure and at the same to improve the conditions for the traffic modes of the environmental network are described in Chapter 4.5.4. They are presented in detail for concrete situations in the report for concept areas.

From the point of view of noise reducing planning, the potentials for noise reduction should be extensively used by all measures to promote the traffic modes of the environmental network.

Measures promoting the environmental network should exploit all noise reducing synergy effects.

²⁶ Strategy for Bicycle traffic für Berlin, Berlin House of Representatives, Official Recor, 15/3360 dated 11/04/2004; the increase aimed at corresponds to an annual growth of 100.000 daily passages.

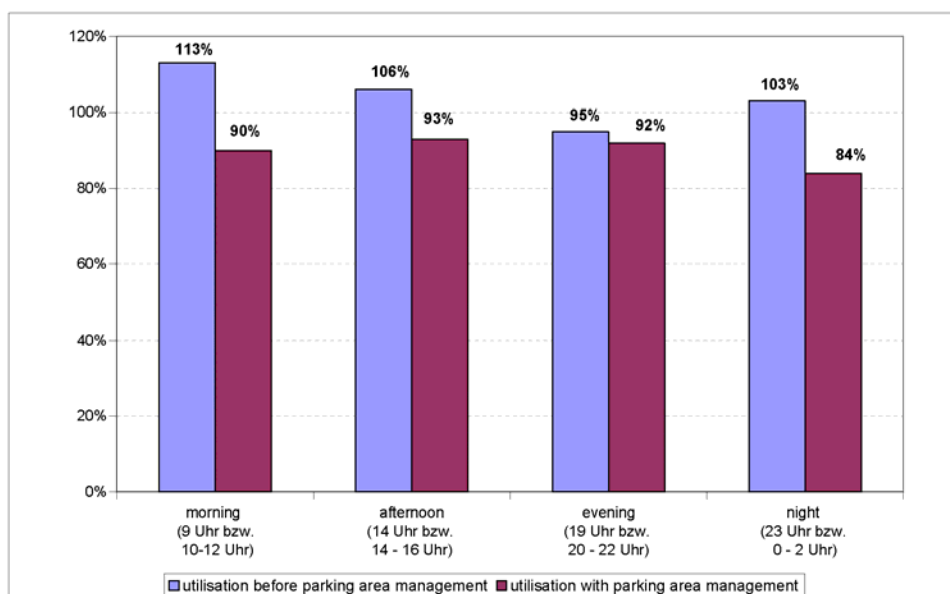
²⁷ Nevertheless not every additional passage with the bicycle replaces a motorcar passage; there are also interrelationships with public transport and pedestrian traffic

5.2.2 Mitigating Source and Target Traffic with Parking Area Management

An adequate parking area management can contribute to reduce noise exposure reducing passenger car target traffic (e.g. by commuters) and local traffic searching parking lots. The goal is to shift these passages towards less noisy traffic modes.

Studies in Berlin Mitte show that with parking area management the average parking lot efficiency could be improved substantially. Residents and businesspeople could find parking lots easier. More commuters come to work without a passenger car.

■ Illustration 6 Modification of the Efficiency of Parking Lots through Parking Area Management²⁸



Furthermore an inquest showed that 80% of the residents and 70% of the businesspeople were satisfied, or mainly satisfied with parking area management²⁹.

The introduction of parking area management has further positive effects on low noise traffic management. The availability of parking space and the establishment of delivery areas³⁰ make it possible to prevent parking in the second row and therefore interference with traffic flow can be avoided.

The percentage of parking offenders can be reduced by intensive control and this definitely improves the terms for delivery traffic, cyclists and pedestrians.

A central measure in the action program of "StEP Traffic" is to assess step-by-step if parking area management in inner city areas with a high demand for car park can be extended. Parking area management, together with other strategies has an important role to avoid and to shift traffic towards low noise traffic modes. It definitely contributes to promote quieter traffic.

²⁸ Planungsgruppe Nord PGN by assignment of the borough administration Mitte in Berlin, Department for Roads and green areas: Inquest of the status quo and further study of the parking area management in Berlin Mitte, Kassel, October 2006

²⁹ idem

³⁰ A limitation by time of the delivery areas allows for more parking lots and increases the acceptance of parking area management

By reducing target traffic to the city centre, the highly exposed major access radial routes to the inner city (most of them are noise focuses) can be relieved from passenger car traffic and noise pollutions.

The introduction of parking area management should also be used in the corresponding areas to improve the disposition of road space, thus contributing to a better traffic flow and better conditions for pedestrian and bicycle traffic as well as for public transport.

The Senate cannot implement the recommended extension of management in its "StEP Traffic". It can only decree regulations for parking tariffs and support the boroughs with their parking area management (for instance with the 'Leitfaden Parkraumbewirtschaftung' (Guideline for Parking area Management))³¹ or inform the public³², because the boroughs are responsible for the introduction, implementation and control of parking area management.

The acceptance of an extension of parking area management within the Berlin population is not easy to attain. This transpired from by a referendum in the borough of Charlottenburg-Wilmersdorf in 2007.

A step-by-step extension of parking area management is recommended from the point of view of noise reduction. To this effect, the lacking acceptance of part of the Berlin population for parking area management should be encountered with appropriate measures, such as an increased information and clarification on the necessary and positive effects.

A long-term implementation of parking area management by the boroughs should be supported by the senate administration. This can be done, for instance, by regulating the tariffs for parking permits of residents or by simplifying the issue of visitors' vignettes. Feasible approaches can be found in the mobil21research project "ParkenBerlin" ("Parking Berlin") of the BMVBS³³. This research examines the existing handicaps for the implementation of parking area management and works out practical recommendations together with the senate and the boroughs.

Continue the gradual extension of parking area management to reduce source and target traffic in the inner city.

Use the options gained by parking area management to design low noise road spaces

Increase information of the public about the advantages for residents and visitors/clients

³¹ Senate Administration for Town Development Berlin: Guideline for Parking Area Management, December 2004

³² Senate Administration for Town Development Berlin: Flyer „Information About Parking Area Management in Berlin“, December 2006

³³ Edited by: Difu/LK Argus/VMZ/Bezirk Mitte

5.2.3 Mobility Management in Companies

The improvements of infrastructure and opportunities for low noise traffic modes alone are not sufficient to change attitudes towards traffic. Mobility management encompasses measures that convey information and generate incentives to use low noise traffic means.

Mobility management in companies and enterprises aim at the promotion of environmentally sound and secure commuter mobility. Mobility management is focussed primarily on employees, because the highest potentials and the highest efficiency of the envisaged measures is expected.

Current mobility data in Berlin show that private transport is dominant with commuters. Not only the percentage of passenger car passages but also the number of driven km are relevant. Whilst the percentage of commuter traffic on all daily passages is around 16%, the percentage of kilometres amounts to 22%.

Research of the effect of mobility management measures in companies, provides evidence that it is possible to reduce a percentage of around 20% on commuter private transport in individual companies.

The noise action plan encourages to initiate projects of company mobility management in Berlin.

Especially companies with a high percentage of employees working on shifts with very early or very late shift changeover or companies located in sensitive areas are interesting for mobility management on account of noise reduction (industrial plants, logistic companies, hospitals, etc.). Avoiding night private transport from or to these locations can definitely reduce noise effects.

The participants in this operative mobility management are the individual companies. The Senate Administrations for Environment, Health and Consumer Protection and for Urban Development as well as the Chamber of Industry and Commerce can promote mobility management in companies on varying levels:

- Implementation of pilot projects with different structures and firm/local characteristics: e.g. public administration, industrial plants, business parks (pool-solutions), hospitals, educational establishments³⁴
- Implementation of an area wide information campaign (companies as targets) e.g. together with VBB, BVG and S-Bahn (interurban train)
- Implementation of an area wide information campaign (employees as target group)
- Publication of guidelines for individual target groups
- Implementation of model and image campaigns
- Implementation of measures in the own administration (offices)

The implementation of a pilot project in an adequate institution (hospitals) is a first step to win specific insights for Berlin and to create a fundament for action guidelines and information campaigns.

Initiate or implement pilot projects for mobility management in companies and/or locations that are highly relevant concerning noise reduction

³⁴ The reports about the concept areas Reinickendorfer Straße and Frankfurter Allee Nord make an exemplary description of approaches for mobility management of establishments located in the areas

5.2.4 Park & Ride Strategy

Park & Ride Strategies are eligible especially for commuters from the suburbs to transfer to public transport. According to the Statistic Report of the Department for Statistics Berlin-Brandenburg³⁵ this applies to 160.000 commuters from residential counties in the Land Brandenburg to Berlin. A total of 660.000 passages per person can be attributed to source and target traffic to Berlin (in comparison: internal traffic Berlin: 7.1 million passages per person)³⁶.

The passages of suburb traffic are only partly directed to the centres, there are many independent relations between the outskirts and the boroughs³⁷.

Considering the volume and the interdependence of passenger car traffic liable to be influenced by Park & Ride, it is clear that only a small percentage of passenger car passages in the town area are relevant for this strategy.

There are already 9.350 Park & Ride parking areas available at regional transport, suburban train and subway stations in the Berlin town area and in the near suburbs³⁸. In some areas an extension of Park & Ride facilities is planned.

The competition for areas in densely built areas, the low cost efficiency of Park & Ride as well as local environmental pollution by parking lot search is a setback to an extension of Park & Ride facilities. An extension of Park & Ride facilities would also reduce the demand for public transport in the outskirts.

Park & Ride strategies, because of their low potentials, are not instrumental for a reduction of traffic and noise exposure.

It is not recommended to follow up this strategy within the Noise Action Plan due to the low efficiency of Park & Ride and the problems linked with it. Possible effects of Park & Ride on noise exposure Hot Spots are small. The extension of the Park & Ride offers for several stations in the outskirts should be examined taking into account the effects of noise in their surroundings³⁹

³⁵ Statistical Reports Statistics Department for Berlin-Brandenburg, edited November 2007, data dated 6/30/2006

³⁶ Senate Administration for urban Development Berlin, Public Transport Plan of the Land Berlin 2006-2009, Berlin 2007, Page 34; the data stems from 2004, data of the StEP Traffic show a smaller number of internal traffic passages: 5,9 (public and individual transport, 1998 and profnosis for 2015 (Senate Administration for Town Development, StEP Traffic, Page 63)

³⁷ Senate Administration for Urban Development Berlin, Public Transport Plan of the Land Berlin 2006-2009, Berlin 2007, Page 34

³⁸ Senate Administration for Urban Development, Mobilität der Stadt -Berliner Verkehr in Zahlen, (Mobility in theTown- BerlinTraffic in Numbers), Ed. 2007

³⁹ In the joint statement of the Chamber of Commerce and Industry, Berlin, the Chamber of Trade and the Carrying Trade Guild of Berlin and Brandenburg in response to the noise reducing plan project for Berlin – Action Plan – the potentials for Park & Ride at several railway stations are remarked upon.

5.3 Traffic Net Design and Traffic Control Concept Modules

Traffic net redesign and traffic control are appropriate means to shift passenger car traffic and noise pollutions, if appropriate roads that can accommodate it are available and it can be expected that no new conflicts are generated by increased noise exposure.

The “StEP Traffic” describes the net design for passenger car traffic. It establishes the network of major traffic roads (status quo and target net 2015) with its traffic functions. Furthermore the StEP presents planned additional road net connections.

The StEP aims to shift traffic by extending and reorganising of road net, especially in the inner city area.

The Noise Action Plan’s traffic control measures of are based on the net design of the “StEP Traffic”.

The Noise Action Plan has following concept modules:

- Shifting passenger car traffic to extended road net connections
- Shifting traffic within the status quo net
- Traffic control of freight traffic

Traffic shifting measures are:

- Sign-posting traffic towards to the desired traffic relation
- Measures at knots to pre-empt the desired traffic relation
- Measures to reduce the capacity of the roads to be relieved
- Measures to reduce speed and therefore the attractiveness for thorough traffic
- Thoroughfare interdiction for specially noise freight traffic (full-time or temporary restrictions)

3.3.1 Shifting Traffic to New Road Connections

The road infrastructure in Berlin will be extended mainly to remove functional deficiencies and to relieve sensitive town areas.

The Noise Action Plan aspires to use the relief potentials of new road connections for heavily exposed areas as intensely as possible.

The risk of an increased traffic and noise exposure on the access roads to the new road connections has to be considered. The 16th BImSchV provides for higher standards against noise for the new road than for road renewal.

Parallel to the relief secured for the existing road segments by new roads, it is fundamental to secure a reduced traffic exposure through adequate measures, for instance⁴⁰

- **Neue (New) Quitzowstraße (Mitte):**

The Neue Quitzowstraße in the first section of its construction between Perlebergstraße and Pultzbrücke relieves the existing Quitzowstraße. There is further relief to be expected by the envisaged continuation to Beusselstraße. This is to be supported by the modification of the traffic junction Beusselstraße/Siemensstraße (number of lanes, LSA-control) and the redesign of Beusselstraße.

- **Südost-Verbindung (Southeast Connection) – eastern road segment (crossing of the river Spree) (Treptow-Köpenick):**

For an optimal relief of the thoroughfare road segments Edisonstraße/Siemensstraße/Spreestraße across Ober and Niederschönweide complementary measures to the Southeastern Connection are necessary on the existing thoroughfare road segments, to adjust the capacities to the desired traffic volume. Furthermore the relevant traffic junctions have to be adjusted to the desired modified traffic routing. As soon as the crossing of the Spree is realised, the already highly exposed Baumschulenstraße will be expecting additional traffic. Appropriate measures have to be taken to counteract the increase of traffic exposure.

- **A113 / A100 (Treptow-Köpenick, Neukölln-Rixdorf)**

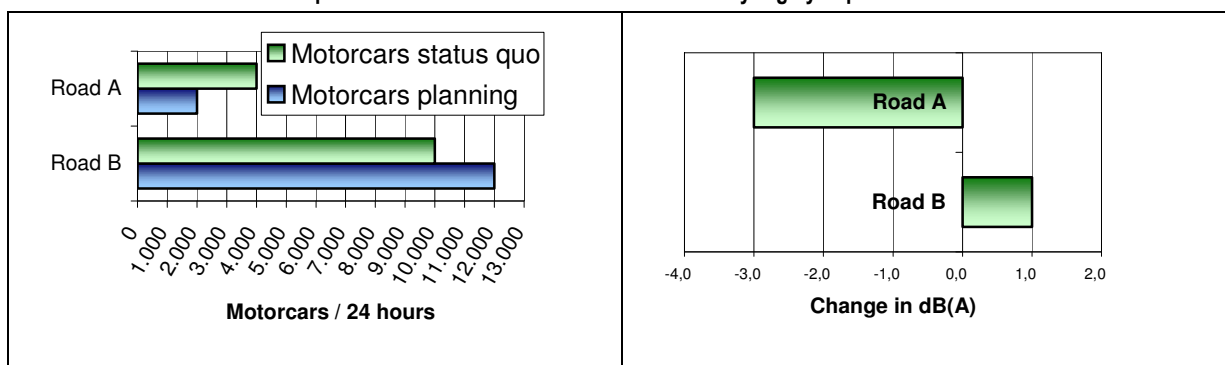
An extensive relief for the succession of roads Adlergestell/Schnellerstr./Michael-Brückner-Straße will be attained with the construction of the A113 and the A 100. To be able to effect the aimed relief, this road succession should be remodelled as a town street when it is finished. When A113 is completed, first relieving steps shall be implemented by interim measures.

If road net extensions are realised, the highest possible relief of noise focuses should be aspired. Therefore a simultaneous implementation of measures to control traffic flow, especially measures to reduce capacity are necessary in the roads planned for relief is necessary.

5.3.1 Shifting Traffic within the Status-Quo Net

To concentrate traffic on major traffic roads with a high amount of passenger car traffic has the advantage that the reduction of noise exposure on roads less affected by traffic is considerably higher than the increase of noise exposure on already highly exposed roads.

- **Illustration 7 Acoustic Impact of the Concentration of Traffic on Already Highly Exposed Roads**



⁴⁰ The examples are documented extensively in the reports concerning the concept area Ober- and Niederschönweide and the concept road segments Baumschulstraße and Beusselstraße.

A definite noise reduction through bundling can be attained on roads in which due to their structure there is a high noise exposure even with a relatively low traffic volume.

For a possible shifting of traffic to road segments liable to take over bundled traffic routes, on one hand these have to be capable to contain a stronger exposure (sufficient capacity), on the other the shifting should not generate an intolerable increase of noise exposure. **Shifting traffic to areas already suffering critical air pollution should avoided by all means.**

An examination within the Noise Action Plan shows that the possibilities to relocate traffic within the status quo net are small. Nevertheless it is necessary to assess possible relief and the additional exposures involved in a local small scale, including also critical road segments.

The tangential deviation concept of the “StEP Traffic” pursues the “shifting of one part of the existing thoroughfare traffic across the city centre to existing, respectively new tangential connections”. This concept is connected with strategies to reduce passenger car traffic.

From the point of view of noise reduction this concept is welcome. The general traffic reduction should guarantee that noise exposure on noise focuses of the planned deviation road segments don't increase considerably and intolerably.

In the concept areas dealt with, further small-scale local shifting of traffic are proposed, for instance⁴¹

- A reduction of traffic on Schloßstraße in Steglitz-Zehlendorf Borough should be implemented by relocations to the A 103
- The road sequence Siegfriedstraße/Rüdigerstraße/Schottstraße/Alfredstraße/Atzpodienstraße should be relieved by small scale relocations to Josef-Orlopp-Straße

The necessary measures of traffic control and bundling within the status quo net will be discussed in detail for the concept areas.

The shifting of traffic within the status quo net aspires to bundle traffic on insensitive segments and/or the generously dimensioned major axes. Special attention has to be paid to the effects on air pollution.

A further reduction of passenger car traffic volume is necessary for an effective bundling of passenger car traffic onto the major axes.

⁴¹ The examples are documented in detail in the reports concerning the concept areas Reinickendorfer Straße, Wilhelmstadt, Steglitz-Schlossstraße and Frankfurter Allee Nord

5.3.2 Traffic Control of Lorries

The Town Development Plan Traffic (StEP-Verkehr) describes in its "Partial Strategy Commercial/Freight Transport" goals and measures for an effective and compatible handling of necessary freight traffic. It is important to avoid unnecessary heavy freight traffic and to increase its efficiency as well as to create incentives for alternatives to freight traffic on roads.

Possible measures are:

- To strengthen other modes of transport for goods traffic
- Goods traffic logistics to reduce transport service on road transport
- To handle road transport on the road net in a compatible way with the urban situation

Surveys for an overall urban management concept for freight traffic show the limitations of a possible bundling of lorry traffic. Even if the aspired relief in a larger area is attained, heavier exposures in the Hot Spot segment were predicted, this also being critical because limit values in air pollution are exceeded.

The Noise Action Plan tests measures for freight transport (management, limitation) that include possible local small scale navigation, bearing in mind the preferential lorry net defined, or measures that concentrate on specific time spans (night).

It is important to develop measures for road segments, aside of the preferential lorry net defined that have high noise pollution created by lorry traffic⁴².

■ Map 9 Freight Traffic Exposure with Relevant Effects on Noise

A considerable noise reduction could be achieved by reducing the percentage of freight traffic within the road segments treated here. The average levels generated by freight transport could be reduced as well as the peak levels.

To achieve this, lorry traffic bans (excepting target traffic) or time restrictions for freight traffic (only at night) are very suitable measures. Traffic management measures or speed restrictions for non displaceable freight traffic can contribute to a reduction of noise exposure by freight traffic and thus to cut peak levels.

Examinations made for the Noise Action Plan show that the scope for relocating freight traffic is limited due to the urban structures with mixed uses.

A small scale analysis is necessary. The possibilities to relocate freight traffic and its effects on the roads to which it is shifted, have to be assessed for each road.⁴³

Due to the limited shifting potentials, measures to handle freight traffic in a compatible way within the road space have to be assessed. Therefore measures to limit speed and improve traffic flow are significant, most of all to reduce noise peaks.

⁴² Lorry percentage (Day or Night) >5% or absolute lorry exposure > 500Lorries/24h with a lorry percentage (Day or Night) > 2%.

⁴³ Because in the existing traffic model linking matrixes especially for freight traffic are lacking, it is not possible to show the possibilities for relocation. With the updated traffic model 2005 eventually small scale effects of relocation can be evaluated also for freight traffic

Recommendations for concrete measures regarding freight traffic and possibilities for its management are made for the concept areas and the concept road sections, e.g.⁴⁴

- Freight vehicle ban in Hertastraße (concept area Neukölln/Rixdorf) together with the existing ban for Silbersteinstraße
- Freight vehicle ban at night in Weißenburger Straße (concept area Wilhelmstadt)

The objective of shifting freight traffic is to increase traffic concentration on the preferential net, if exposure limits allow.

To minimise large scale thorough freight traffic on the A 113, 100 and 100 we recommend to examine the possibility of implementing traffic management measures⁴⁵

It should be aimed to organise measures for the remaining lorry traffic in a more compatible way

5.4 Traffic Management and Road Space Concept Modules

Traffic management and road space measures should handle the remaining passenger car traffic so as to attain environmentally sane and quiet results.

The modules are:

- Renewal of traffic lanes
- A concept for speed
- A concept for traffic flow
- A concept for road space design

5.4.1 Road Lanes Renewal

The height of noise exposure also depends on the surface of the lanes, their condition and –connected to it – the allowed maximum speed. Concrete and paved surfaces have a noise increasing effect (additional 1 to 6 dB(A)). A damaged asphalt surface also increases noise (additional 1 dB(A)). Damaged road surfaces not only increase the average levels but also generate higher peak levels.

With the special road surface renewal program between 2005 and 2007 road surfaces have been systematically renewed. From 2008 onwards the boroughs receive 6 million Euros as additional means for road maintenance.

The choice of the measures to renew surfaces is often made taking into account the reduction of noise pollutions and vibrations. The improvement of the condition of the lanes can definitely reduce pollutions generated by road

⁴⁴ The examples are documented in detail in the reports regarding the concept areas Wilhelmstadt and Neukölln/Rixdorf

⁴⁵ To minimise the thorough freight traffic on A 113, A 100 and A 111 there is a number of possibilities that should be examined. Some of them are the dynamic signposting with realistic time information (such as: across Berlin: 60Minutes, around Berlin: 30 Minutes), the prevention of a dynamic routing across Berlin in the navigation systems, for instance through TMC signals or a road toll adjustment (higher tolls for crossing Berlin), see also the joint statement of the Chamber of Commerce and Industry, Berlin, the Chamber of Trade and the Carrying Trade Guild of Berlin and Brandenburg

traffic. The elimination of lane damages can avoid the peak levels generated by bumping and stroking noises occurring in this zones.

The following table shows the relief potentials of the renewal measures of the last years as well as the hypothetical maximum possible relief potentials of a complete lane surface renewal in the examined net.⁴⁶

The complete renewal of the noise lane surfaces can bring a relief between 3 and 6 dB(A) (paved surfaces) on 1% of the Hot Spots. A maximum of 7% relief between 1 and 3 DB(A) can be attained on further lanes (concrete).

■ **Table 12 Relief potentials through the surface renewal programme – Planned and implemented measures 2005/2006 and potentials through further complementary measures**

Noise exposure / affected Persons	Analysis 2005	With Implementation Lane-Renewal-Program	with Lane Renewal in all Hot Spots
Percentage of Length of Sections with Noise Exposure (in %)			
> 65 dB(A) in the Night	8,5 %	8,2 %	6,9 %
> 60 dB(A) in the Night	34,1 %	33,8 %	32,0 %
Percentage of People Affected by Noise Exposure (in %)			
> 65 dB(A) in the Night	10,2 %	9,7 %	8,3 %
> 60 dB(A) in the Night	34,8 %	34,7 %	33,3 %

- Concrete slab surfaces are often used in combination with integrated streetcar tracks; a renewal of these whenever the tracks have to be renewed has a high cost-benefit effect. To reduce high exposures due to the streetcar noise, track renewal has a high priority⁴⁷
- a renewal of tracks and the substitution of large composite panels should be aimed at for further noise focuses, dominated by passenger car traffic noise.
- The major traffic net seldom has paved surfaces. The renewal of paved surfaces should be implemented taking into account design requirements and the qualities of paving. Asphalt surfaces should be used for traffic lanes with high traffic exposure.
- A third of the assessed road segments show a damaged asphalt surface. Noise Reduction Planning does not recommended any measures due to the high costs and a relatively low acoustic effect (lower than 1 dB(A)) in an overall scale. Nevertheless a renewal of asphalt surfaces step-by-step should be pursued if funds are available, because peak levels can be reduced. Further synergy effects can be used for instance, when bicycle lanes are built.

The need to reduce noise exposure through lane surface renewal is specified in the concept areas.

⁴⁶ Based on: Updated Noise Map 2005; the data regarding lane surfaces are based upon information of the buroghs about measures on lanes in the last years

⁴⁷ see also chapter: local trains, it shows the primary segments of track and also lane renewal to reduce the streetcar noise, these should be implemented because of their synergy effects.

Additionally, noise focuses all over the town with a high noise reduction potential given by renewal of lane surfaces or by replacement of very noisy lane surfaces should be relieved. To do this, a systematic examination of the data used for the assessment of pollutions in road lanes in problematic areas is necessary.

Before measures for secondary roads with paved surfaces are recommended, data related to traffic exposure should be updated.⁴⁸

Lane renewal should be continued.

Assessment if further financial means can be provided to establish a program "Low-Noise Road Lanes" - with the objective to replace extremely noisy road surfaces (including large composite panels) on very strongly frequented sections.

Synergy effects with rail renewals should be used.

Data referring to road lanes should be updated for the future program.

Besides the replacement of noisy road surfaces, the possibility to adopt special low-noise road surfaces should also be examined, having in mind the limits and costs of their use:

- Low noise road surfaces are important especially with high speeds because the rolling noises are louder than the engine noises. It is sensible to apply asphalt with open pores (OPA) as a low noise surface for autobahns, because it has been proved it has noise reducing effects for speeds > 60 km/h.
- Open pore asphalt, also the so-called two-layer OPA with noise reduction effects from tempo 50 onwards is not suitable for built up roads in the city centre because they are not suitable for the particular traffic flow and the combination of traffics therein.
- An technically optimised asphalt coating for noise effects that is currently starting to be applied with good results, is an alternative for open pore asphalt⁴⁹. Technical limitations for these asphalt coatings are as yet unknown⁵⁰.

For all these reasons the implementation of noise reducing surfaces in the Hot Spot areas is for the time being not yet a usable solution because they have not yet been sufficiently tested and a specification of the limits for their technical application is yet lacking. Nevertheless it should be examined in the near future. Current pilot projects (Düsseldorf) should be followed, the implementation of a pilot project in Berlin could be recommendable.

Highly exposed major access roads are possible application areas for OPA and noise optimised asphalt coatings for surface renewals, if the costs and the expected benefits in each individual case seem sensible.

The current state of the art products for low noise road surfaces should be provided for pending surface renewals of noise Hot Spots on highly frequented major access roads.

⁴⁸ For Bötzwstraße (Friedrichshain-Kreuzberg) and Windscheidstraße (Charlottenburg-Wilmersdorf) – both are paved roads, no data for 2005 is available

⁴⁹ See also Radenberg, Martin; Sander, Rolf: Lärmtechnisch optimiert – Asphaltdecksichten für den kommunalen Straßenbau (technically optimised for noise - asphalt coatings for comunal road construction), Asphalt, Heft 8/2007, S33-41

⁵⁰ A test for the application for the noise optimised asphalt coating is being run in Düsseldorf – the results assessed regarding noise reducing effects and durability are positive – the possibilities for its appliance in Berlin have to be assessed in cooperation with the boroughs.

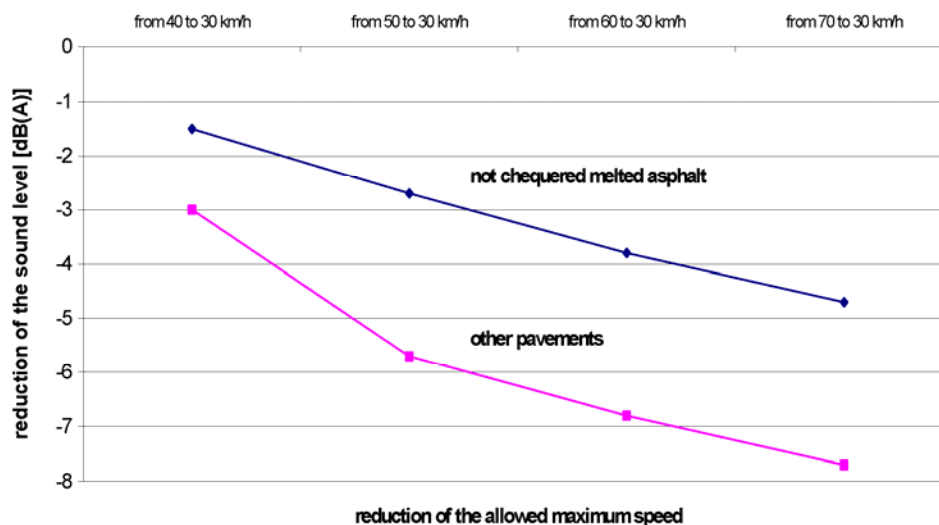
5.4.2 Speed concept

The reduction of the allowed maximum speed is an effective and cost saving measure to reduce noise. Tempo 30 regulations also have positive synergy effects for road safety, amenity values and air quality.

Depending on the proportion of freight traffic, a reduction of the average values by 2 to 3 dB(A) can be achieved by reducing speed from 50 km/h to 30 km/h on the same lane surface. Peak values can be reduced up to 9 dB(A).

The difference between Tempo 50 and Tempo 30 can amount 6 dB(A) on paved surfaces.

■ Illustration 8 Reduction of Noise Levels depending on Speed Reduction and Road Surfaces⁵¹



With tempo 30 a lower speed and smoother traffic flow have a positive effect on noise pollution. The steadiness of traffic coming along with a reduction of maximum speed from 50 to 30 km/h can reduce the average noise level by 2 dB(A) and the maximum noise level by 4 dB(A).

In the pilot project "Protection of traffic noise" in the years 1999/2000 noise measurements assessed the effects of speed reducing measures. Level reductions between 0,7 dB(A) and 2,7 dB(A) (average level at night) were assessed on 13 segments of major traffic roads with tempo 30 at night, even if regulations were not always abided. Parallel to this there was an inquest among the neighbours to find out their subjective perception of noise reduction. The results show 1 dB(A) less on the average level was already perceived as a definite reduction of noise annoyance.

Tempo 30 brings Relief from Traffic Pollutions and Improve Road Safety

Based on thorough research⁵² the Senate Administration for Urban Development in 2005 established Tempo 30 zones on 16 segments of the major traffic net. This was done consistently on road segments that are particularly exposed to noise and air pollution and in which accidents are frequent.

⁵¹ From: LAI – AG Aktionsplanung: LAI-Hinweise zur Lärmaktionsplanung (LAI-considerations for Noise Action Planning)– gemäß UMK-Beschluss 33/2007 von der Umweltministerkonferenz zur Kenntnis genommen (according to the UMK (conference of the environment ministers)-resolution, S. 19

⁵² VMZ Berlin Betreibergesellschaft mbH im Auftrag der Senatsverwaltung für Stadtentwicklung Berlin: Minderung der Umweltbelastung und Erhöhung der Verkehrssicherheit durch Reduzierung der zugelassenen Fahrgeschwindigkeiten im Straßennetz der Stadt Berlin (Reduction of Environmental Pollution and Increase of Traffic Safety through Reduction of Allowed Speed in the Road Net of Berlin), Dokumentation, Berlin Juni 2005

The 16 segments altogether have a length of between 167 and 880 metres each and add up to a total length of 5.380 metres. This brings relief to approximately 4.700 residents.

The most important goal of this tempo 30 regulation is the integral improvement of polluted situations by mitigating noise and air pollution and reducing accident frequency.

The existing Tempo 30 (at night) concept

The overall concept to introduce Tempo 30 at night⁵³, identifies road sections that fulfil the established criteria for tempo 30 at night. The implementation of these measures has been decided and will be carried out successively:

The requirements needed to establish Tempo 30 at night are:

A very high noise exposure during the night (>65dB(A) in areas with mixed uses and in the established Tempo 50 road net and a level of > 60 dB(A) in residential areas and in the remaining major traffic road net. The number of people harmfully affected has to be high and no important public transport should run in the road section.

Based on existing traffic data, Noise Action Planning recommended and determined an extension of the Tempo 30 (night) concept for several additional road sections that lie considerably above the limit value of 60 dB(A) at night⁵⁴.

■ Table 13 Mitigating potentials by implementation the Tempo 30 (night) concept

Noise exposure / People affected	Analysis 2005	With implementation of Tempo 30 at night
Proportion of the Length of Sections with Noise Exposure (in %)		
> 65 dB(A) at Night	8,5 %	7,7 %
> 60 dB(A) at Night	34,1 %	32,4 %
Proportion of the People Affected with Noise Exposure (in %)		
> 65 dB(A) at Night	10,2 %	8,5 %
> 60 dB(A) at Night	34,8 %	33,8 %

With the implementation of Tempo 30 at night highly exposed areas can experience noise relief. Nevertheless a considerable proportion of sections with high noise disturbances at night remain.

The tempo 30 (night) concept, that changes speed regulations at night in a length of approximately 50 km⁵⁵ is singular in this dimension in Germany. To improve its effectiveness, technical means (displays) and/or a stronger speed limit controls have to be carried out and their effectivity evaluated.

Tempo 30 in front of primary schools

In August 2008 the Senate Administration for Urban Development laid the foundations for the introduction of Tempo 30 regulations in front of 60 Primary and Special Schools on major traffic roads during opening hours of the schools to improve traffic security. Through these measures the noise exposure in these road sections can be

⁵³ VMZ Berlin Betreibergesellschaft mbH im Auftrag der Senatsverwaltung für Stadtentwicklung Berlin: Einführung von Tempo 30 nachts im Berliner Hauptverkehrsstraßennetz – Dokumentation des Vorgehens und der Abwägungsergebnisse des Arbeitskreises (VMZ Berlin by appointment of the Senate Administration for Town Development: Introduction of Tempo 30 at Night in the Berlin Major Traffic Road Net – Documention of the Procedure and the Appreciation results of the working team), Berlin, Januar 2008

⁵⁴ VMZ Berlin Betreibergesellschaft mbH im Auftrag der Senatsverwaltung für Stadtentwicklung Berlin: Einführung von Tempo 30 nachts im Berliner Hauptverkehrsstraßennetz – Diskussion der Anfragen aus der Lärminderungsplanung (VMZ by appointment of the Senate Administration for Town Development : Introduction of Tempo 30 at night in the Berlin Major Traffic Road Net – Dealing with Questions Related to the Noise Reduction Planning), Dezember 2007

⁵⁵ including complementary proposals with a total length of 1,4 km

reduced. If they coincide with noise focuses with Tempo 30 regulations at night, the regulations will be unified and a full time Tempo 30 regulation will be implemented.

Long-Term Assessment of Further Tempo 30 Sections

The implementation of further Tempo 30 road sections in the middle and long-term should be studied if their positive effects have been assessed by success controls on the established Tempo 30 road segments.

The basic reason to do this, is always high noise exposure. The noise exposures for the road segments must exceed the limit values of the 1st stage (>70dB(A) day/60dB(A) at night)⁵⁶.

Furthermore Tempo 30 is can be especially suited in cases where further effects are envisaged:

- Tempo 30 to support traffic management measures:
Speed limits⁵⁷ can support the reduction of the attractiveness to drive through roads
- Tempo 30 to support measures promoting bicycle traffic:
The promotion of traffic modes of the environmental network is focussed on the improvement of conditions for bicycle traffic. If the implementation of bicycle lanes isn't possible but at the same time there is evidence of risks for bicycle drivers, one possible measure could be the establishment of Tempo 30.
- Tempo 30 to reduce the dividing effects of roads and to improve their amenity:
Often very exposed roads are also important business centres with high requirements as to their amenity values. At the same time and for the same reason the necessity to cross the streets is very high. Tempo 30 and the reduction of noise annoyance can be improve their amenity value.
- Tempo 30 to reduce peak values coming from high freight traffic exposure:
Freight traffic is a considerable generator of high noise exposure. A reduction of freight traffic through relocation is only possible in few cases, because alternative roads often do not exist and/or the streets' access functions are the reason for freight traffic.
Therefore the implementation of Tempo 30 should be studied to reduce the peak values of lorry traffic.
- Tempo 30 as a possible alternative to passive noise insulation measures,
if it can be assessed that no other measures are liable to reduce noise.

These are the criteria for the recommendations to study implementation of further Tempo 30 road sections in the concept areas and in the complementary net with less traffic relevance. They are documented in the materials for the concept areas.

The long-term study of further Tempo 30 policies in the StEP Net ⁵⁸ from the point of view of noise reduction, should be envisaged as a cost-saving and effective measure.

Roads with small traffic importance (outside the StEP-Net) and high noise exposure should be destined for a short-term implementation of Tempo 30 or the integration into Tempo 30 zones.

⁵⁶ these limit values are equal to the standard values in the directives for road measures to protect the population from noise (Lärmschutzrichtlinien-StV zu §45 StVO) for residential areas and other institutions worthy of protection (e.g. Hospitals)

⁵⁷ alternative measures to reduce the capacity, such as road redesign are – compared to tempo 30 - definitely more expensive

⁵⁸ For the definition of Net see the Town Development Plan for Traffic – Stadtentwicklungsplan (StEP) Verkehr

5.4.3 Concept Traffic Flow

Together with speed, the noise level of passenger cars is determined by speed distribution resulting from disturbances of traffic flow.

■ Illustration 9 Influence of Speed Distribution on Noise Pollutions⁵⁹

Illustration 9 shows that with the allowed speed for traffic in town (maximum 50 km/h) a steady traffic flow definitely generates less noise than a speed distribution with varying velocities. With an undisturbed traffic flow it is possible to keep an even velocity, a vehicle can be driven with lower engine rpms. Disturbances in traffic (for instance resulting from parking cars in the second row, or by individual speeding motorists) generate additional accelerating and braking, which is extremely noisy.

It is possible to achieve a maximum potential for noise reduction of up to 2,4 dB(A) at 50 km/h and up to 4 dB(A) at 30 km/h by steadying traffic flow⁶⁰. A steady traffic flow at a slow speed level offers the highest potentials for noise reduction.

In practice, the reducing effects of steady traffic have an average value of approximately 1 dB(A) at 50 km/h and up to 2 dB(A) at 30 km/h. Furthermore peak levels can be cut down.

Additionally, steadying traffic has a high synergy with clean air planning because acceleration and braking produce air pollution.

Traffic junctions (road crossings with competing traffic flows) and disturbances within road sections generating acceleration and braking are relevant potential disturbance factors for traffic flow.

It is possible to improve the steadiness of traffic flow on consecutive traffic junctions by coordinating traffic lights. Still there are very limited possibilities to give one individual traffic flow a priority within the closed meshed net of the Berlin major traffic roads with a variety of competing traffic flows –passenger cars and cyclists, pedestrians, buses and streetcars. The concerns of public transport and bicycle traffic should not be impaired by “green waves”.

A coordination of traffic lights changing during different hours of the day already exists for many access roads.

To be able to steady up traffic on major road axes with coordinated traffic lights, the possibility to set up displays with a recommended speed should be studied (for instance on Heerstraße in Charlottenburg).

On the other hand, the implementation or improvement of “green wave” connections enhances the attractiveness of a road for thorough traffic and this can have a counterproductive effect on noise reducing planning.

To make thorough traffic more attractive through the “green wave” on the major axes in combination with the bundling strategy (in Chapter 5.3.2), can contribute to the desired relief of parallel roads.

To disconnect the traffic lights at night can support steadiness of traffic at night. This measure has to be studied in each case and set against safety concerns. Alternatively, a green wave with Tempo 30 at night might be sensible, especially to back up Tempo 30 at night regulations.

The possibility of implementing or improving a “green wave” to mitigate noise on highly exposed radial roads with high noise pollution and reduced traffic quality or with traffic jams⁶¹ (e.g. Mehringdamm) should be studied.

⁵⁹ Heinz Steven, SILENCE - Quieter Surface Transport in Urban Areas, Project funded by the European Community under the ‘Sustainable Development, Global Change and Ecosystems’ Programme

⁶⁰ See Umweltbundesamt (Federal Environmental Office) (Hrsg.), Handbuch Lärminderungspläne (Handbook Noise Reducing Plans), 1993

In the concept area Steglitz, for Albrechtstraße between Robert-Lück-Straße and Klingsorstraße⁶², it is recommended to study the possibility of disconnecting traffic lights at night as an alternative to a LSA-coordination

The implementation of a “green wave with adjusted speeds” on major traffic roads, having public transport in mind, should be closely examined

An appropriate street design in certain road sections can support the steadying of traffic flow between traffic junctions. An elementary design feature is the width of the lanes. (See also chapter 5.4.4 for appropriate road space measures)

Accompanying surveys of the implementation of measures on exemplary road sections and evaluations of effectiveness regarding the influence of street design measures on steadying of traffic flow and speed level.

⁶¹ According to the evaluation of the traffic quality on selected road segments in 2006 ,
in: Senatsverwaltung für Stadtentwicklung, Mobilität der Stadt – Berliner Verkehr in Zahlen, Ausgabe 2007 (Senate
Administration for Urban Development, Mobility of the Town, Berlin Traffic in Numbers, Edition 2007)

⁶² This example is documented in detail in the report for concept area Steglitz

5.4.4 Road Space Design Measures

Road space design with the objective to reduce noise can include a variety of approaches. To be able to assess their effect, it is essential to evaluate their effect concerning other objectives, (for instance the improvement of opportunities for low noise traffic means, improvement of the amenity of road spaces) in addition to the efficiency analysis regarding noise reduction. The aspired synergy effects are also helpful to gain acceptance for noise reducing measures and to make their implementation easier.

Potentials and Interactions of Road Space Measures

■ Adjustment to the Capacities for Vehicle Traffic

The current traffic census data (Traffic census 2005) show stagnant and decreasing (especially in the inner city) traffic exposure. The latest traffic census also show an even traffic distribution during the day and consequently less pronounced peak hour exposures. From this it transpires that there are chances for road space measures with noise reducing effects in some roads of the Berlin major road net.

A reduction of lanes or their width that allows to handle the existent or envisaged traffic exposure, creates possibilities to bundle passenger car traffic in the middle, thus moving it away from the buildings and leaving space for other traffic participants.

Measures to subdivide road space and organise traffic, influence the capacity for traffic of a road section (although the capacity of the junctions is essential). Measures that reduce the capacity of roads by changing the use of the lanes lead to a modified distribution of traffic within the net, together with a possibly lower traffic exposure in the redesigned segment. Road space measures can support desired shifting effects.

To shift traffic towards other roads increases the traffic exposure and the noise pollution on the latter. These measures have to be assessed in an overall survey. It is necessary to study noise reducing measures on road space leading to a reduction of the number of lanes or their width in each separate case, depending on traffic intensity, the composition of the different traffic modes and further requirements, such as parking, delivery, etc. The existing uses in extra large lanes with flexible use of lane parts have to be considered.

■ Promotion of the Traffic Modes of the Environmental Network

A further overall goal of the road space noise reducing measures is to improve the conditions for non-motorised road users and public transport⁶³. Measures to improve the side spaces in streets for pedestrians and cyclists as well as for bus and tram stops support long term strategies to reduce passenger car traffic redistributing it to less noisy traffic modes.

The improvement of the conditions for pedestrian and bicycle traffic also has a positive effect on traffic security.

Measures to promote the environmental network, thus reducing passenger car passages have synergy effects with the reduction of air pollution.

⁶³ taking into account the program to accelerate public transport

Direct Effects of Road Space Measures

■ **The Distance between Noise Sources and Buildings Increases**

Road space measures that allow for a greater distance between traffic as a source of pollution and the built-up areas, have a direct noise reducing effect. The reduction of road lanes, the reduction of lane widths and hence the extension of the side spaces in streets, enlarge these distances.

These measures lead to a reduction of noise levels as well as to an additional reduction of noise perception. The attainable reduction depends on the kind of sound field. If the buildings are attached, high rise and closely built, there will be multiple reflections and only a small reduction of approx. 0,5 dB(A) will be possible. Otherwise a reduction of up to 1,5 dB(A) can be attained⁶⁴.

■ **Slowing Down and Steadying Traffic**

Road space measures that reduce road lanes or modify road profiles in a selective way, support the compliance of traffic participants to an adjusted speed level.

Road space measures also help to steady and improve traffic flow. The width of the lanes is an essential design element. Narrow lanes generally contribute to steady traffic flow. In cases of frequent disturbances in the curb area, such as parking, delivering, etc., to provide lanes for flexible use, that permit to drive past vehicles leaving the curb.

A steadying of traffic flow can also be attained by a sum of individual measures, such as traffic islands, bus capes and expansions of footpaths.

In practice to steady traffic has a noise reducing effect between 1 dB(A) (at 50km/h) and 2 dB(A) (at 30 km/h). The noise reducing potential of an optimised traffic flow is distinctly higher (see Chapter 4.4.3).

■ **Improvement of the Quality of Road Space**

An improved design of the road space influences the perception of noise disturbance positively. An attractive design, amenity in the side spaces and the greening of roads contrive to a better subjective perception of road spaces and can reduce the disturbing effects of noise.

Recommendations for Noise Reducing Road Space Measures

The following road space measures in qualified road spaces are recommended for the concept areas⁶⁵:

We differentiate linear measures, often related to a new distribution of lanes in a road section, from measures at certain points, modifying the road profiles in specific sites.

Often it is reasonable to combine several measures with noise reducing effects.

The steps for the implementation of noise reducing road space measures will be tested on 4 exemplary road segments.

⁶⁴ LAI – AG Aktionsplanung: LAI-Hinweise zur Lärmaktionsplanung – gemäß UMK-Beschluss 33/2007 von der Umweltministerkonferenz zur Kenntnis genommen, S. 20 – According to Remarks about Noise Action Planning stipulated by the Conference of the Secretaries of the Environment 33/2007

⁶⁵ A great number of proposals for road space measures are included in the reports for the respective concept areas

Linear measures

■ The Introduction of on Road Lanes

An important effect of installing bicycle traffic facilities from the point of view of noise reduction is besides promoting a low noise traffic mode, to reduce the lane width and to move the passenger car lanes away from the built-up areas (in the width of bicycle lane).

To promote the extensive use of bicycle traffic, cycle lanes should be installed on all major traffic roads, as far as traffic exposures allow⁶⁶.

The shifting of existing but unsatisfactory cycle paths on pedestrian areas to the street lanes also improves the conditions for pedestrian traffic.

■ The Abolition of Parking on Footpaths

An economic measure in noise reducing planning to improve the conditions for pedestrian traffic is to abolish parking on footpaths.

The shifting of parking to the street lanes can reduce noise by increasing the distance of the lanes to the buildings.

■ Establishment/improvement of Special Bus Lanes

Special bus lanes contribute to reduce the disturbances of bus traffic because they allow their unimpeded flow and also create a larger distance between noisy passenger car traffic and buildings.

Special bus lanes, even for a limited time space, on roads with high bus traffic frequency, make bus traffic more fluid and less obstructed.

For the time being, the possibilities to install new special bus lanes in the Berlin major traffic road net are exhausted. There is the possibility, within noise reducing planning, to enlarge existing bus lanes for a safer use by bicycle traffic.

■ The Installation and/or Development of Lay-byes

The perceived width of the lane surface is defined by the lane itself and by the neighbouring areas. An unused lay-by or a lay-by near the curb enlarges the lane optically and induces to higher speed.

Marking lay byes can diminish the (optical) width of lanes and lessen speed level.

When redesigning or building new roads it is recommended to design separate lay-byes, e.g. by using surfaces with different materials.

■ The Installation of Delivery Areas in Lay-byes

To install delivery areas on lay-byes helps to steady traffic flow, because parking in a second row can be avoided. In streets with existing extra large lanes it is important to mark delivery zones, especially when bicycle facilities are installed.

Delivery zones should be installed according to demand, possibly for special times of the day.

⁶⁶ According to the recommendations for bicycle parths ERA 95, bicyclepaths are to be installed on roads in which the speed of motorcar traffic is not distinctly lower than 50km/h and traffic exposure is higher than 10.000 motorcars/24h. On roads with a speed distinctly below 50km/h cycle paths are to be built, if the exposure is higher than 15.000 motorcars/h. The possibilities and limitations of implementation of different bycle paths are described in the directive for the building of town roads RASt 2006.

■ **The Installation of a Median Strip**

Additionally to the improvements near the curbs, the installation of median strips (traffic islands) on extra large lanes or on lanes with an over dimensioned number of lanes is worthwhile as a noise reducing measure.

It is particularly adequate on roads with shops on both sides of the street and with a high crossing demand over their total length. Besides improving crossing possibilities, it contributes to reduce speed levels and to steady traffic.

In some cases the installation of a median strip can attain a noise reduction even if it does not bundle passenger car traffic in the middle of the street and the costs are relatively high. This Noise Action Planning proposes this measure for Pichelsdorfer Straße in the concept area Wilhelmstadt.

Point Measures

■ **Traffic islands**

Traffic islands have a positive influence on speed and traffic flow because along with them the street profile changes. They attract the attention of car drivers and thus prevent speeding.

There also have synergies with traffic security and the promotion of pedestrian traffic.

■ **Pedestrian Crossings (Zebra-Crossings)**

Pedestrian crossings (zebra crossings) are centres of attraction in the same way as traffic islands counteracting speeding. they also have synergies with traffic security and the promotion of pedestrian traffic.

■ **Enlargements of Footpaths**

The interruption of lay byes, tree verges and also pulling the footpath nearer to the streets in road crossings create enlargements of footpaths. They set a frame for the street space in its passage to the footpaths and are a suited as a complementary measure (e.g. to traffic islands) to reduce extra large lanes at certain points with a positive influence on speed.

Footpath enlargements facilitate crossing streets and also have synergies with traffic security and the promotion of pedestrian traffic.

■ **Bus Stop Capes**

Bus-stop capes can set a frame for road space at least at certain points. This can support an adjusted speed level. Buses stopping on the road contribute to make the road less attractive for thorough passenger car traffic. Thus bus stop capes can support noise reducing traffic management measures.

Bus stop capes contribute to make public transport more attractive, to accelerate bus traffic and they allow the buses to approach the stops directly, thus improving the conditions for waiting passengers.

■ **Trees**

Trees and other design elements serve to differentiate street spaces vertically. In many Berlin roads trees exist on the sides, the tree lines should be completed. Existing tree sites should be improved.

Trees in the streets also influence noise perception. Noise exposure is perceived as less disturbing in roads with greenery.

Procedural Recommendations when preparing the implementation of road space measures

A variety of road space measures contributing to a reduction of noise exposure were elaborated for the concept areas and the concept road sections.

These measures are approaches to design a low noise traffic flow.

The elaboration of the road space measures was made based on available planning data and a complementary status-quo survey (from Summer 2007). The planning proposals follow the existing laws and directives (especially traffic laws and complementary directives⁶⁷) and the recommendations for the design of road spaces (especially the directives for the building of town roads RAS^t 06⁶⁸ and the Regulation Papers of VLB).

The fundamental planning proposals of Noise Action Planning were elaborated for the assessed road segments in the concept areas and discussed with the Senate Administration for Urban Development, respectively with the concerned boroughs. Detailed planning proposals were made for selected exemplary road segments by elaborating special site plans.

The discussions with the Senate Administration for Urban Development and the Boroughs has evidenced, that the achieved planning levels are not sufficiently detailed to be able to make decisions on the implementation of the planning proposals.

Further detailed plans are necessary, in which also problems that could not be elaborated within the Noise Action Planning have to be handled, for instance, if the capacity of the traffic junctions is sufficient, or questions regarding existing pipelines which have to be accounted for.

The planning proposals for road space measures elaborated, tried to consider mostly low cost measures. The measures don't necessarily have to be tied to costly refurbishment of road spaces. For instance, traffic surfaces can be distributed in a new way by marks and thus can have a positive effect on noise disturbance. Large refurbishments of road spaces are proposed only for special cases. Nevertheless some of the measures are linked with relevant investments and their financing has yet to be assessed.

Because further detailed studies and the coordination of planning proposals are necessary, as well as the evaluations of effectiveness of the proposed measures and the assessment of their financing, the planning proposals for road space measures were assigned to the middle and long term program for activities (Stage 2) of the noise action program.

Furthermore during the discussions for the coordination of the planning proposals it was evident, that there are not enough experiences concerning some of the described measure proposals to substantiate the assumptions that the refurbished roads will have the sufficient capacity to handle the existing traffic.

The short term program for measures of the noise action plan (Stage 1) includes, based on pilot studies, the implementation of 4 exemplary road sections to test road space measures contributing to a steadying of traffic flow and thus also to noise reduction. Further measures to improve the conditions for the other traffic modes and the design of road space are envisaged. These measures are linked with changes in the conditions passenger car traffic flow that based on existing experiences and directives, seem acceptable but whose effect has to be

⁶⁷ StVO – Straßenverkehrsordnung, www.bundesgesetzblatt.de

⁶⁸ Forschungsgesellschaft für Straßen- und Verkehrswesen e.V. FGSV (Research Society for Roads and Traffic matters): Richtlinien für die Anlage von Stadtstraßen (Directives for the building of Town roads) RAS^t 2006, Köln, 2006; in Berlin eingeführt mit Rundschreiben über die Einführung der Richtlinien für die Anlage von Stadtstraßen (RAS^t 06) der Forschungsgesellschaft für Straßen und Verkehrswesen (FGSV), Arbeitsgruppe Straßenentwurf vom 03. Dezember 2007

evaluated in practice. To be able to assess the effect and the adequacy of the proposed measures to improve traffic flow, accompanying research should be done, before making decisions to transfer these measures to other roads.

5.5 Timing of the Implementation of Measures of Noise Reducing Planning

The developed measures for noise reduction are differentiated according to:

- Measures to be realised within a short-term (Stage 1) and
- Middle to long-term options for measures (Stage 2)

5.5.1 Short-term Measures 2008-2012 (Stage 1)

Feasible short-term measures of stage 1, so far as they have not been marked for special examination in the measure catalogue, are already being implemented or are in preparation within various planning proceedings. They should be implemented in the next 5 years (2008-2012). The continuation of the planning and coordination proceedings and the safeguarding of their financing are necessary.

In addition to the currently planned measures, the implementation of the road space measures on 4 exemplary road sections is a central feature of the short-term measures. The noise reducing effects of road space measures are to be demonstrated based on these exemplary road sections, especially the implementation of the recommended measures including traffic concerns⁶⁹ should be assessed.

The catalogue of short-term measures in the concept areas and the concept road sections (see Chapter 5.6) includes:

- Existing plans having positive effects on noise development (e.g. renewal of roads surfaces, bicycle traffic strategy measures, as far as they can be realised in the concept areas)
- Complementary short-term measures that can be implemented in the concept areas or on the concept road sections
- Road space measures on the 4 exemplary road segments.

5.5.2 Middle- and Long-term Options for Measures (Stage 2)

There are many open questions in the field of the middle- and long-term options for measures that could not be treated conclusively in the current Noise Action Planning.

The reports regarding the concept areas (see documents for the action plan) provide detailed material for concrete middle to long-term measures. Later on, these will have to be pursued in successive steps.

The outline concepts "passenger car-traffic and local trains" provide strategies and concepts for noise reducing measures that possibly will have to be substantiated on other levels.

⁶⁹ e.g. traffic security, the opening up function, the importance of the road space for bicycle use, public transport concerns and general technical (e.g. pipeline administrations) and traffic legislation concerns

For the development of middle- and long-term options for measures, the following aspects should be considered:

- Measures to avoid traffic are closely related to questions concerning overall and local urban as well as traffic development and are tied together by complex interactions. Their realisation will have to be incorporated into overall and local planning – especially when updating StEP Verkehr (traffic) and in local traffic and land use concepts.
- Traffic management measures (especially for freight traffic) and their effects on traffic are always to be considered within the overall road net. Now that the Traffic Model 2025 is available, the general conditions for these measures are definitely better.
- The enacted Tempo 30 regulations allow definite noise reductions on 50 km of the Berlin major road net. Possibly further Tempo 30 regulations should be put into practice in the middle or in the long-term having in mind the experiences made with the implemented regulations.

Before preparing the details and the implementation of the great amount of recommendations for street space measures, the necessary steps should be clarified and the experiences with the realisation of exemplary measures, regarding their effects on traffic and noise reduction, should be collected. This shall be done with the 4 exemplary road sections.

5.6 Catalogue of Noise Reducing Measures for Passenger car Traffic

The overall Noise Action Planning for Berlin was not able to develop a catalogue for measures for all the roads in which the limit values of the action plan were exceeded.

Therefore the Noise Action Plan proposes to elaborate typical solutions for typical problem areas or problem road sections. A detailed study was made for 12 selected concept areas and 8 selected concept road segments (see Table 1 and Map 1).

Planning for measures in the concept areas and on the concept road segments

A total sum of 87 km highly exposed road sections (Hot Spot sections) was considered within the framework for the concept areas and the concept roads. These are 28% of a total of 310 km.

Beyond this, the four pilot studies of the Noise Action Planning of the last years already surveyed 53 km of the Hot Spot sectors. These are further 17% of the total Hot Spot sectors.

The description of possible noise reducing measures for all concept areas and roads is based on detailed analysis of the present status, the noise exposures and disturbances as well as evaluations after to the Quality Indicator System. Recommendations for measures for noise reduction are made taking into account existing planning:

- Measures to avoid passenger car traffic in the concept area or to shift passenger car traffic to environmentally sound traffic modes
- Measures to control or manage traffic, e.g. freight traffic control and speed regulations
- Recommendations for road space measures such as the installation of bicycle traffic facilities and traffic islands (Stage 2)

The proposed noise reducing measures in the concept areas are fundamentally planning proposals. Whilst the measures of Stage 1 – excepting those marked for examination - are conclusive, the measures of Stage 2 need a differentiated examination, especially from a traffic point of view. (See also Chapter 2.2 Footnote 2 on Page 8).

The reports for the concept areas (see documents for the action plan) provide besides the short-term measures considerable material for concrete appropriate middle to long-term measures that can successively be pursued later on.

The following outlines for the concept areas give a first outline of the problems in the concept areas and the chosen approaches to solutions. The presentation is focussed on short-term measures.

5.6.1 Concept Area Reinickendorfer Straße (Mitte)

The concept area Reinickendorfer Straße lies in the Borough Mitte, Wedding District. It comprises important radial roads such as Müllerstraße, Reinickendorfer Straße (the federal road B 96) and Prinzenallee/Wollankstraße and parts of the middle ring road (Seestraße/Osloer Straße).

The area is characterised by high density residential buildings. Another important feature of the concept area is that a considerable number of institutions with high noise sensitivity, especially schools and hospitals within it are exposed to noise.

The concept area Reinickendorfer Straße is an example for a town quarter on the limit of the city centre, marked by radial and tangential traffic having itself a significant internal traffic.

The noise action plan focuses on the mitigation of source and target traffic. The South western and the neighbouring areas of the concept area are characterized by industrial and working locations (e.g. Schering, Hospitals). To reduce commuter traffic to these destinations, company mobility management should take measures to direct their employees towards other traffic means. It should be assessed if, or in which areas parking management could be introduced to induce passenger car users to use low noise traffic means.

Bicycle traffic should be promoted with more emphasis to reduce passenger car traffic. An exemplary local net was developed for this purpose that complements and improves the existing facilities and the plans of the Senate Administration for a bicycle path infrastructure.

Guidelines for action for a stronger bundling and relief of exposed areas that can be implemented by traffic management and road space measures, are shown for the major traffic road net. The goal is to reduce traffic in the axis constituted by Schulstraße, Exerzierstraße and Badstraße, parallel to Osloer Straße.

It is striking that there is a large number of major net roads with high noise disturbances. A thorough noise reducing design concept will be developed ("the Reinickendorfer Straße") for these.

A basic module of the short-term measures is the redesign of four exemplary road sections, which will allow to transfer the knowledge won about planning procedures and the effects on traffic and noise reduction of the proposed road space measures. In the concept area Reinickendorfer Straße plans for a low noise redesign for the exemplary road section Prinzenallee and Drontheimer Straße were elaborated, which shall be implemented within the short-term measures of the noise action plan.

■ Illustration 10 Concept Area Reinickendorfer Straße with Short-Term Proposals for Measures

The following short-term measures are recommended for the concept area Reinickendorfer Straße:

■ Table 14 Concept Area Reinickendorfer Straße – Proposals for Short-Term Measures (Stage 1)

Measures for Traffic Management		
Traffic Flow		
①	Drontheimer Straße between Osloer Straße and Soldiner Straße	Reduction of the allowed maximum speed to 30 km/h at night (Planned / being realised)
②	Barfussstraße/Transvaalstraße between Edinburger Straße and Guineastraße	
③	Schönwalder Straße between Reinickendorfer Str. and Kunkelstraße	Reduction of the allowed maximum speed to 30 km/h (Planned / being realised)
Road Space Measures		
④	Barfussstraße between Müllerstraße and Edinburger Straße	Surface renewal on both sides of the road (being realised)
⑤	Müllerstraße between Seestraße and Sansibar Straße/Gebietsgrenze① (Planned)	Installation of bicycle facilities (Marking of optional lanes)
⑥	Prinzenallee between Badstraße and Osloer Straße (Exemplary Sector)	Exemplary redesign: Installation of bicycle facilities (Marking of optional lanes), Improvement of road space organisation Accompanying surveys of the implementation
⑦	Drontheimer Straße between Osloer Straße and Ritterlandweg (Exemplary Sector)	

- ① Installation of bicycle facilities in the Area Seestraße to Afrikanische Straße is planned

Effects on noise

Only very small changes in traffic exposure are expected after the implementation of Stage 1 measures in the concept area Reinickendorfer Straße. The implementation of the proposed road space measures in the exemplary sections Prinzenallee and Drontheimer Straße can lead to small shifting of traffic to the neighbouring net. We propose to assess this within the accompanying survey and to implement complementary measures if shifting occurs.

The noise disturbances in the surveyed area Reinickendorfer Straße will decrease partly after the short-term measures are implemented:

- The proposed redesign of Prinzenallee and Drontheimer Straße (the short-term redesign of exemplary roads) can reduce the noise level by as much as 2,5 dB(A) in Prinzenallee and by 1,5 dB(A) in Drontheimer Strasse. Considering additionally the implementation of Tempo-30 regulation now in action, the noise level will drop by 5.5 dB(A) at night.
- The recommended short-term road space measures in Müllerstraße and road space measures combined with surface renewals in Barfussstraße lead to level reductions by as much as 2 dB(A).
- The directive for Tempo 30 (night) regulations now being implemented in Drontheimer Straße and Barfussstraße can lead to distinct level reductions at night. Combined with further measures (reorganisation of the road space, surface renewal) these can reach up to 5,5 dB(A).
- In Schönwalder Straße the implementation of Tempo 30 for daytime now being realised, leads to a level reduction of 3 dB(A).

Further measures that can contribute to a reduction of noise exposure and whose implementation is recommended in the middle or long-term, are described for the concept area Reinickendorfer Straße. Measures to mitigate traffic by company mobility management and parking area control, traffic organising measures to

implement the conceptions for bundling traffic and for road space measures, which as a rule include the installation of bicycle facilities and the improvement of the conditions for pedestrian traffic are described here.

These measures are described in the detailed documents accompanying the concept area Reinickendorfer Straße. Further studies and extensive studies as well as coordination are necessary for their implementation.

5.6.2 Concept Road-Section Beusselstraße (Mitte)

The selected concept road Beusselstraße lies in the Borough Mitte, Moabit district, on the northern edge of the “Hundekopf” – (Dog’s head). The concept section starts at Sickingenstraße in the North and ends at Kaiserin-Augusta-Allee in the South.

The concept road Beusselstraße is exemplary for a communication road on the northern side of the city in an area with intensive and mixed uses with a high percentage of business traffic.

The development of the concept is based on existing planning for Beusselstrasse, especially refurbishing plans for an extensive traffic calming and the pilot project HEAVEN. The measures discussed for these projects are taken up and modified in the Noise Action Planning.

The recommendations for noise reduction are instrumental to seize the chances for traffic relief that are created by the construction of the new Quitzowstraße. By reducing the capacity of Beusselstraße, the road space measures developed contribute to make thorough traffic on it less attractive and thus to win potentials for a more urbane and silent handling of passenger car traffic.

The measures should be implemented – preferably together with the realisation of the western sector of Neue Quitzowstraße - in a middle to long-term.

■ **Illustration 11 Concept Road Section Beusselstraße with Proposals for Short-term Measure.**

For the short-term a stronger control of speed regulations (Tempo 30) is recommended.

■ **Table 15 Concept Road Sector Beusselstraße – Proposals for Short Term Measures (Stage 1)**

Organisational Traffic Measures		
Traffic Flow		
①	Beusselstraße between Siemensstraße and Kaiserin-Augusta-Allee	Stronger control of Speed Regulations (Tempo 30)

Effects on Noise

The positive noise effects linked with the speed reduction can be attained best in the short-term with a reinforced control of the Tempo 30 regulations.

Middle to long-term traffic reductions and road space measures together can induce a level reduction between 3 and 4 db(A).

5.6.3 Concept Area Boxhagener Viertel (Quarter) (Friedrichshain-Kreuzberg)

The concept area Boxhagener Viertel is connected with Frankfurter Allee on the South, it is limited in the West by Warschauer Straße and in the East by Gürtelstraße / Bahnhofstraße. The southern border is defined by Revaler Straße / Simplonstraße, which leads to Ostkreuz (Eastern Junction).

The area is marked by a compact fin de siècle built up area. It is one of the most densely populated areas of the town and has a typical tenement building structure.

The concept area Boxhagener Viertel is typical for a densely built inner city quarter, in which local and partly thorough traffic are superimposed.

There are very high use requirements in the narrow road spaces – passenger car traffic and high demand for parking space, Streetcars and a number of amenity functions.

The noise reduction conception for the Boxhagen Viertel focuses on the support of an urban adapted and low noise access to the area by promoting traffic modes of the environmental network and by means of road space design.

External traffic, having traffic conditions in mind (also in the neighbouring areas), and the noise disturbance caused by it, should be excluded as far as possible. The reorganisation of the road net in the near and farther neighbourhood of the Boxhagen Viertel leads to the assumption that with the help of further supporting measures thorough traffic in the area recedes.

The traffic in the area should be devised in an environmentally compatible way through parking area management and the promotion of traffic modes of the environmental network. The remaining passenger car traffic in the area should be as quiet as possible with an adjusted speed level. For the existing streetcar traffic further rail renewal should contribute to noise reduction.

■ **Illustration 12 Concept Area Boxhagen Quarter with Proposals for Short-Term Measures**

The following short-term measures are envisaged for the concept area Boxhagen Quarter:

■ **Table 16 Concept Area Boxhagener Viertel –Proposals for Short-Term Measures (Stage 1)**

Organisational Measures for Traffic		
Traffic flow		
①	Boxhagener Straße	Reduction of the allowed Maximum Speed to 30 km/h at night (currently planned / currently implemented)
Road Space Measures		
②	Grünberger Straße	Construction of a traffic island in the area Simon-Dach-Straße (presently being tested, possibly also LSA)

Effects on Noise

The shortly realisable reduction of maximum speed to 30 km/h, allows a reduction of noise levels by 2-3 dB(A) (at night).

With measures to be assessed in the middle- and long-term (especially rail and road surface renewals), with traffic relief and a steady traffic flow with adjusted speed levels, noise levels in the noise focuses can be reduced at an average of 2 to 4 dB(A).

Further noise reductions are possible through long-term measures to reduce traffic volume.

5.6.4 Concept Area Mehringdamm and Concept Road Section Gitschiner Straße (Friedrichshain-Kreuzberg)

The concept area Mehringdamm lies at the southern border of the inner city (Großer Hundekopf – Large dog's head) in the Borough of Friedrichshain-Kreuzberg).

It comprises an area of approx. 3,5 km² around the street junction Mehringdamm / Wilhelmstraße from North to South and Yorckstraße / Gneisenastraße, respectively the Canal bank roads / Gitschiner Straße in the East-West direction.

The area around Mehringdamm has been declared as a zone with mixed uses and a concentration of retail business. Beyond this, the concept area Mehringdamm is marked by residential buildings north and south of Gitschiner Straße.

The concept road section Gitschiner Straße lies in the concept area Mehringdamm. Residential buildings and a high percentage of green areas in the southern neighbourhood mark the road.

The concept area Mehringdamm and the concept road Gitschiner Straße inside it are exemplary for an area with a very high percentage of thorough traffic that cannot be relocated due to their position in the existing and the planned road nets.

In the area a bundling of traffic on the higher ranking roads can relieve the roads of the complementary net and in subordinate roads. The adjustment of the capacities for passenger car traffic through adequate dimensioning of lanes and road space design are suited measures. These consider the planned reclassification of the road net. The resulting possibilities to act can be used to improve the conditions for low-noise traffic and the amenity of roads. The regulation of different maximum speeds to support bundling is yet to be assessed.

The concept road Gitschiner Straße will fulfil the function of a super ordinate road connection – also in the future. The limited room for manoeuvre should be used to improve the conditions for bicycle traffic by installing bicycle lanes.

A central module for short-term measures is the redesign of four exemplary roads, from which knowledge about planning procedures and the reducing effects on traffic and noise of the proposed road space measures can be won. Plans for the low-noise redesign for the concept road Dudenstraße in the concept area Mehringdamm were elaborated that should be implemented within the short-term measures of the noise action plan.

The renewal of damaged and noisy lane surfaces and the planned installation of bicycle facilities on the road lanes are further proposed short-term measures.

■ Illustration 13 Concept Area Mehringdamm and Concept Road Gitschiner Straße with Proposals for Short-Term Measures

The following short-term measures are recommended for the concept area Mehringdamm and the concept road Gitschiner Straße:

■ Table 17 Concept Area Mehringdamm and Concept Road Gitschiner Straße - Proposals for Short-term Measures (Stage 1)

Road Space Measures		
①	Katzbachstraße (Dudenstraße to Kreuzbergstraße)	Installation of bicycle facilities / Marking of optional strips (Planned)
②	Wilhelmstraße (Stresemannstraße to Gebietsgrenze)	
③	Lindenstraße	
④	Gneisenau Straße	Road surface renewal and renewal of sections of pavements and bicycle paths – on both roadsides (in the Section Baerwaldstraße to Solmstraße already realised)
⑤	Wilhelmstraße (Stresemannstraße - Gebietsgrenze)	Road surface renewal (linked with the installation of bicycle facilities)
⑥	Gitschiner Straße	Installation of bicycle facilities Improvement of traffic flow and traffic security on traffic junctions
⑦	Dudenstraße (Exemplary road)	Exemplary redesign: Installation of bicycle facilities (Marking of optional strips), Improvement of road space organisation, installation of traffic islands Accompanying surveys to implementation

Effects on noise

Small reduction of noise exposure can be attained by implementing short-term measures:

- A short-term regulation of tempo 30 at night is not envisaged for the concept area Mehringdamm
- Noise reductions of up to 2 dB(A) can be attained by short-term road space measures (installation of bicycle facilities on the lanes of Katzbachstraße, Wilhelmstraße and Lindenstraße)
- The implementation of road space measures in the exemplary road section Dudenstraße leads to a reduction of noise exposure of 2 dB(A).
- The installation of bicycle strips after the abolition of parking strips is envisaged for the concept road Gitschiner Straße. A noise level reduction will not be attained. It is recommended to assess the possibilities of passive noise protection measures for the concerned areas.

It is recommended in a middle to long term basis to bundle traffic on the major road net to be able to relieve subordinate, yet highly exposed roads in the concept area Mehringdamm.

This strategy should be accompanied by road space measures and speed limits in the roads that are planned for relief. It is possible to attain considerable level reductions:

- Only a small, hardly perceptible increase of noise exposure is to be expected from the bundling of traffic on Mehringdamm (=,5 dB(A). On the other side a reduction of traffic in the roads to be relieved lead to a considerable reduction of noise exposure – in Großbeerenstraße in combination with road space measures and Tempo 30 to as much as 8 dB(A) – in Möckernstraße to 5 dB(A) on Katzbachstraße to 2,5 dB(A).
- With the installation of Tempo 30 regulations (yet to be explored) noise reduction of up to 30 dB(A) at night can be reached on Gneisenaustraße – Yorckstraße and on Gitschiner Straße (the stretch from Alexandrinenstraße to Lohbeckstraße).

The conditions for other traffic means, traffic security and road space quality will be positively influenced.

5.6.5 Concept area Mierendorffinsel (Mierendorff Island) (Charlottenburg-Wilmersdorf)

The concept area Mierendorffinsel lies in the Borough of Charlottenburg-Wilmersdorf and is limited by the Spree River, the Westhafen (Westport) Canal and the Charlottenburg connection Canal.

Mierendorffinsel is characterized by residential and business uses in equal parts as well as by green areas and garden plots.

In this area there is a high traffic exposure on one inner city radial road (Tegeler Weg) and on access roads to the area combined with high development dynamics from various urban planning projects. Additionally there is a town quarter management to mitigate social Hot Spots and to reevaluate the area around Mierendorffplatz (Mierendorff Square). The concept area stands as an example for an area close to the centre with parallel roads and with different sensitivities.

The noise reducing planning concentrates on the following aspects:

- Avoidance of traffic noise by promoting the environmental network, a reduction of passenger car target traffic and precautionary urban planning
- Measures to control and manage traffic in order to bundle and shift thorough traffic to attain a better flow and lower speed
- Road space measures to reevaluate the relieved areas and to renew road surfaces
- To cooperate with the quarter management and thus gain synergies

■ **Illustration 14 Concept Area Mierendorffinsel with Proposals for Short-term Measures**

■ **Table 18 Concept Area Mierendorffinsel – Proposals for Short-term Measures (stage 1)**

Organisational Traffic Measures		
Road space measures		
①	Mierendorffstraße / Mierendorffplatz	Replacement of paving on the lanes
②	Lise-Meitner-Straße between S-Bahn (local railway) and Gaußstraße	Replacement of concrete surface and block paving (if funding is clear) by asphalt. In this connection examination of the possibilities to reduce extra large lanes and to move the road axis away from the buildings to the East.

Effects on noise

The implementation of the following short term measures in the surveyed area Mierendorffinsel leads to a reduction of noise disturbances:

- The realisation of the Tempo 30 at night regulation (in the realisation stage) reduces noise exposure at night by 2 – 3 dB(A) in Sömmeringstraße between Kaiserin-August-Allee and Nordhauser Straße.
- The replacement of paving in the northern part of Mierendorffstraße can lower the noise disturbance by 3 to 6 dB(A). The replacement of the concrete surface and the block paving with asphalt in Lise-Meitner-Straße between the S-Bahn line and Gaußstraße has a reducing effect of 3-4 dB(A).
- The proposals for middle and long-term traffic control measures, road space design and speed levels adjustment can sink noise levels by up to 4 dB(A).

5.6.6 Concept Area Wilmersdorf and Concept Road Uhlandstraße (Charlottenburg-Wilmersdorf)

The concept area Wilmersdorf comprehends parts of the western inner city and is limited by Kurfürstendamm (not incl.) and the express-autobahn BAB A 100 (not incl.) and the roads Bundesallee/Joachimstaler Straße (incl.). Within this area there will be a deeper research into the road section of Uhlandstraße between Kurfürstendamm and Hohenzollerndamm.

The concept area Wilmersdorf stands as an example for an inner city area with higher than average a density of use and a mixture of dwellings, services, business, retail stores and industry. Therefore there is a superposition of thorough traffic and local traffic on a very dense road net, that in many places is characterised by large road spaces with a strong dominance of passenger car circulation areas.

Due to the high percentage of local traffic in and to the western city, extensive shifting of traffic isn't possible. The approach to noise reduction concentrates on the following features:

- Avoidance of traffic by promoting the environmental network and reducing passenger car target traffic
- Traffic control and management measures to bundle and shift traffic, allowing a better flow and lower speed
- Road space measures to reevaluate the relieved areas and to renew road surfaces

Exemplary possibilities to reduce noise in central city roads are being assessed on Uhlandstraße in connection with the concept area Wilmersdorf and with the realised building activities that have been carried out in the section next to Uhlandstraße in the south.

- **Illustration 15 Concept Area Wilmersdorf and concept road section Uhlandstraße with proposals for short term measures**

The following short-term measures are recommended for the concept area Wilmersdorf and for the concept road section Uhlandstraße:

■ Table 19 Concept area Wilmersdorf – Proposals for Short-term Measures (Stage 1)

Organisational Traffic Measures		
①	Blissestraße between Wilhelmsaue and Mannheimer Straße, and between Am Volkspark and Varziner Straße	Reduction of maximum allowed speed to 30 km/h at night (planned / being installed)
②	Joachim-Friedrich-Straße between Westfälische Straße and Kurfürstendamm	
③	Konstanzer Straße between Ruhrstraße and Hohenzollerndamm	
④	Paulsborner Straße between Eisenbahnstraße and Brandenburgische Straße	
⑤	Uhlandstraße between Lietzenburger Straße and Straße near Schoelerpark	
⑥	Westfälische Straße between Kurfürstendamm and Johann-Georg-Straße	
⑦	Güntzelstraße	Inclusion into Tempo-30-Zone (the borough is the competent authority)
Road Space Measures		
⑧	Brandenburgische Straße from Hohenzollerndamm to Berliner Straße (exemplary road)	Exemplary redesign: Installation of bicycle facilities, (marking of optional strips), Improvement of the road space organisation Accompanying surveys to realisation
⑨	Joachimstaler Straße from Lietzenburger Straße to Kurfürstendamm	Renewal of road surface / reconstruction (Planned/ being realised)
⑩	Uhlandstraße between Güntzelstraße and Berliner Straße	
⑪	Westfälische Straße between Joachim-Friedrich-Straße and Konstanzer Straße	
⑫	Konstanzer Straße between Lietzenburger Straße and Brandenburgische Straße	Renewal of road surface/reconstruction (Planned / being realised) together with an evaluation of a possible road space redesign
⑬	Uhlandstraße between Lietzenburger Straße and Hohenzollerndamm	Installation of optional strips for cyclists

Effects on noise

The implementation of the following short-term measures will definitely reduce the noise exposure:

- The now being established regulation for tempo 30 at night, (Blissestraße, Joachim-Friedrich-Straße, Konstanzer Straße, Paulsborner Straße, Uhlandstraße and Westfälische Straße) can reduce noise exposure during night time by up to 2 - 3 dB(A). The same effect can be attained during the whole day in Güntzelstraße after it is included in the Tempo-30-Zone.
- The renewal of damaged asphalt surfaces (Joachimstaler Straße, Uhlandstraße, Westfälische Straße) allows a noise reduction of an average value of up to 1 dB(A); additionally, peak levels will be lowered by this measure and the disturbances of the dwellers reduced.
- The redesign of road spaces in Brandenburgische Straße (pilot project), Konstanzer Straße (redesign combined with the lane surface renewal envisaged in the investment plan yet to be assessed) and Uhlandstraße (optional bicycle strips) have a noise reducing potential of 1 –2 dB(A).

- It is possible to attain further noise reductions of up to 4 dB(A) by implementing the recommended middle and long-term measures for traffic control, adjusted speed levels and a steadier traffic flow.

5.6.7 Concept Area Wilhelmstadt (Borough of Spandau)

The concept area Wilhelmstadt reaches Altstädter Ring in the North and Heerstraße in the South (both not included). In the west-east direction the area is limited by the traffic junction Wilhelmstraße / Heerstraße in the West and by the Havel River in the East.

The concept area Wilhelmstadt stands as an example for narrow road spaces away from the city with a high population density. The area is marked by dense mixed uses with predominantly perimeter block development. Residential and commercial uses (in the Wilhelmstadt centre, especially on Klosterstraße and northern Pichelsdorfer Straße) as well as small industries are predominant. There is a risk of segregation in the area due to the moving away of higher income earners and of families with children.

The major traffic axes are Wilhelmstraße / Klosterstraße and Pichelsdorfer Straße both running parallel in the north-south direction as well as Brunsbütteler Damm / Ruhlebener Straße running east-west in the northern part of the area. The traffic exposure is marked by the superposition of local traffic (business, dwellings, recreation) and through traffic.

The approach to noise reduction concentrates on following aspects:

- A higher amenity quality in the residential areas and a better general set-up for the development of businesses.
- A reduction of noise exposure and the creation of latitude for the design of road spaces by shifting through traffic to less sensitive routes
- Reduction of local traffic with parking area management and the promotion of the environmental network
- **Illustration 16 Concept Area Wilhelmstadt with Proposals for Short-Term Measures**

The following short-term measures are recommended for the concept area Wilhelmstadt (Stage 1)

- **Table 20 Concept Area Wilhelmstadt – Proposals for Short-Term Measures (Stage 1)**

Traffic Organisation Measures		
①	Adamstraße between Melanchthonstraße and Pichelsdorfer Straße	Reduction of the maximum speed allowed to 30 km/h at night (Planned / being implemented)
②	Pichelsdorfer Straße between Wilhelmstraße and Tharsanderweg	
③	Weißbürger Straße between Pichelsdorfer Straße and Götzelstraße	
④	Wilhelmstraße between Melanchthonstraße and Pichelsdorfer Straße	
⑤	Weißbürger Straße	Freight traffic ban at night (from 10 p.m. to 6 a.m.)

Effects on noise

The noise exposure in the survey area Wilhelmstadt can be reduced by the implementation of the following short-term measures:

- The night tempo-30 regulation now being implemented (in Adamstraße, Pichelsdorfer Straße, Weißenburger Straße and Wilhelmstraße) can reduce noise exposure at night by 2 – 3 dB(A)
- The proposed ban on lorry traffic (from 10 p.m. to 6 a.m.) in Weißenburger Straße would lower the night average noise level by 2,5 dB(A)
- The middle and long-term recommendations for road space design and for the adjustment of speed levels could bring about further level reductions of 3 dB(A).

5.6.8 Concept Area Steglitz and Concept Road Schloßstraße (Steglitz-Zehlendorf)

The concept area Steglitz reaches Markel- / Feuerbachstraße in the North and Klingsorstraße in the South, Bismarckstraße in the East and the most western part of Grunewaldstraße in the West. Within this area Schloßstraße between Feuerbachstraße and Hindenburgdamm will be reviewed in depth.

The concept area Steglitz and the concept road section Schloßstraße stand as an example for a sub-centre with a superposition of local traffic (business, services, dwellings) and strong thorough traffic across the area on the radial roads towards the city with high requirements as to the amenity on the shopping precincts.

The approaches to noise reduction concentrate on following aspects:

- Avoidance of traffic noise through the promotion of the environmental network and a reduction of passenger car target traffic
- Shifting and bundling of thorough traffic to the A 103 and a few major routes
- Further traffic control and management measures to create a more compatible traffic and a better traffic flow
- Road space measures to reevaluate the relieved areas

On the concept road Schloßstraße as an example for a radial road to the city with high requirements as to its amenity, the possibilities to reduce noise will be studied.

- **Illustration 17 Concept Area Steglitz and Concept Road section Schloßstraße with Proposals for Short-term Measures.**

The following measures are recommended for the concept area Steglitz and the concept road sector Schloßstraße:

■ Table 21 Concept area Steglitz and Concept Section Schloßstraße – Proposals for Short-term Measures (Stage 1)

Organisational Traffic Measures		
①	Klingsorstraße between Goebenstraße and Leydenallee	Reduction of the maximum speed allowed to 30 km/h at night (Planned / being implemented)
②	Bergstraße between Filandastraße and Bismarckstraße	
③	Birkbuschstraße between Schützenstraße and Paul-Schwarz-Promenade	
④	Albrechtstraße between Robert-Lück-Straße and Klingsorstraße	LSA-coordination or overnight shutdown should be assessed.
Road Space Measures		
⑤	Birkbuschstraße between Schützenstraße and Klingsorstraße	Shifting parking from the pavement to the road lane
⑥	Schloßstraße between Feuerbachstraße and Wolfensteindamm	Redesign of the road space (optional strips for bicycle traffic)

Effects on Noise

The noise exposure in the area will be reduced when the following short-term measures are implemented:

- The enacted and partially implemented directive for Tempo 30 at night (in Bergstraße, Birkbuschstraße and Klingsorstraße) can reduce the noise exposure at night by 2 to 3 dB(A).
- The levels in Birkbuschstraße can be reduced by up to 3 dB(A) through a modified disposition of parking bays allowing a steadying of traffic and a greater distance to the buildings
- In Albrechtstraße the average sound level can be reduced by 1 to 2 dB(A) depending on speed by disconnecting the traffic lights during the night; additionally, this measure will reduce peak levels
- The recommended linear measures on Schloßstraße, especially the reduction of the width of the lanes by marking optional bicycle strips, aspire to attenuate the speed level and to steady traffic flow besides improving the conditions for bicycle traffic. Additionally, linear road space measures can have direct acoustic effects of different magnitude. In Schloßstraße the increase of the distance between lanes and buildings by installing of bicycle facilities can attain a relief of approximately 1 dB(A). Combined with the steadying of traffic, noise reductions of between 2 and 3 dB(A) are possible with these measures, depending of the speed level.

The implementation of recommended middle to long-term measures for surface renewal, for road space design and to adjusted speed levels, further reduction of up to 5 – 6 dB(A) can be attained.

5.6.9 Concept area Tempelhof (Tempelhof-Schöneberg)

The concept area Tempelhof reaches from Ringbahnstraße in the North to Friedenstraße in the South (both roads are included in the survey area). It stands as a example for a highly noise exposed area located beyond the S-Bahn ring (interurban train), with parallel major road connections. The structure of the prevailing uses is marked by a mixture of small industries in part, on Tempelhofer Damm and dense residential use (Rathausstraße

/ Mantteuffelstraße). There is a larger convergence of retail stores on Tempelhofer Damm north of the Teltow Canal.

Concerning traffic, the area is dominated by roads running from North to South Rathausstraße / Alarichstraße / Manteuffelstraße and Tempelhofer Damm. The area is characterised by a superposition of local traffic and local thorough traffic.

The approach to noise reduction is concentrated on the following aspects:

- Avoidance of traffic noise by promoting the environmental network and the reduction of passenger car target traffic
- Traffic control and traffic management measures to bundle and shift thorough traffic, to improve traffic flow and to attain lower speed levels.
- Road space measures to reevaluate the relieved areas and to renew lane surfaces
- **Illustration 18 Concept Area Tempelhof with Proposals for Short-Term Measures**

The following short-term measures are recommended for the concept area Tempelhof:

■ **Table 22 Concept Area Tempelhof: Proposals for Short-Term Measures (Stage 1)**

Measures for traffic management		
①	Manteuffelstraße between Ringbahnstraße and Schöneberger Straße	Reduction of the maximum speed allowed to 30 km/h at night (Planned/ being implemented)
②	The stretch of roads Rathausstraße / GERMELMANBRÜCKE / Alarichstraße between Attilastraße and Ringstraße	
③	Arnulfstraße, beyond the limits of the concept area	
Road Space Measures		
④	Friedrich-Karl-Straße	Modification of the arrangement of parking bays
⑤	Rathausstraße between Ullsteinstraße and Ringstraße	

Effects on Noise

The following short-term measures can reduce the noise exposure in the Tempelhof survey area:

- The installation of the Tempo-30 at night in Manteuffelstraße, Alarichstraße, Arnulfstraße and Rathausstraße can reduce noise exposure during the night by 2 to 3 dB(A)
- The recommended linear road measures (in Friedrich-Karl-Straße and in Rathausstraße), especially the reduction of the width of the road lanes resulting from moving the parking strips from the footpath to the lane will bring improvements for pedestrian traffic. Besides, speed level could be reduced and traffic flow improved. Additionally positive direct acoustic effects can be attained by linear road measures. In some roads the increase of the distance between road lanes and buildings can reduce sound level by 1 dB(A).

Together with traffic flow improvements this measures can reduce noise between 2 and 3 dB(A), depending on speed.

The recommended middle to long-term measures to control traffic, to renew surfaces, to adjust speed levels and to design road space can attain further relief of up to 5 dB(A).

5.6.10 Concept Road Potsdamer Straße (Mitte and Tempelhof-Schöneberg Boroughs)

The concept road stretch Potsdamer Straße / Hauptstraße reaches from Landwehr Canal in the North to Kaiser-Wilhelm-Platz (Square) in the South. It stands as an example for an important radial road to the city with a high density of uses and a mixture of dwellings, business, services, restaurants and small trade enterprises. There is a substantial convergence of retail business between Lützowstraße and Bülowstraße. Between Winterfeldtstraße and Kleist Park there is a predominance of residential uses. The whole stretch of the road has attached higher rise buildings.

The “StEP Verkehr (traffic)” characterizes the urban conflict potential of the concept road as relevant. As a part of the federal highway B 1, which is one of the Berlin major radial roads leading to the historic centre of Berlin across Potsdamer Platz (Square), the concept road is highly dominated by passenger car traffic.

Potsdamer Straße has a high percentage of thorough traffic to the city that can't be shifted to other roads. The nearby subordinate road net isn't fit to absorb additional traffic. A wide-ranging shift isn't possible because of the high traffic and noise exposures on the potential alternate routes.

The approach of noise reduction planning concentrates basically on the avoidance of (target) traffic and on road space measures to reevaluate the road. There isn't much room for traffic management with the objective to steady traffic and slow down speed.

■ Illustration 19 Concept Road Potsdamer Straße with Proposals for Short-term Measures

The following short-term measures are recommended for the concept road Potsdamer Straße:

■ Table 23 Concept Road Potsdamer Straße – Proposals for Measures

Traffic Avoidance		
①	Parking space mangement in the souther area should be studied	Assessment of its possible delimitation, cost effectiveness / development of a concept
Road Space Measures		
②	From Schöneberger Ufer to Kurfürstenstraße	Shifting the bicycle paths from the footpaths to the road lanes (bus strip / combined strip) and enlargement of the footpaths
③	From Lützowstraße to Kolonnenstraße	Installation of crossing facilities for pedestrians
④	From Bülowstraße to Kurfürstenstraße; From Winterfeldt- / Alvenslebenstraße to Pallas- / Goebenstraße; From Pallas- / Goebenstraße to Großgörschenstraße	Road surface renewal
⑤	From Schöneberger Ufer to Grunewaldstraße	Enlargement of bus lanes / combined lanes

Effects on Noise

The noise exposures will diminish slightly when the following measures are put in practice:

- The renewal of damaged asphalt surfaces allows a noise reduction of an average level of up to 1 dB(A); additionally this measure will reduce the peak levels and the disturbances for the residents will be mitigated.
- The recommended linear road measures, especially reducing road lane widths by installing larger bus and combined lanes will improve bicycle traffic, mitigate speed level and steady traffic flow. Steadying traffic flow can reduce noise by 1 to 2 dB(A), depending on the speed level.

On the whole, the measures described are apt to reduce noise by 1 to maximum 2 dB(A). The measures developed can only attain comparatively minor reductions of noise exposure. Even if long-term measures to reduce traffic volume will allow further noise reductions, high noise exposure will remain. Within the overall urban Noise Action Planning measures for passive noise protection should be studied.

5.6.11 Concept Area Neukölln / Rixdorf and Concept Road Section Karl-Marx-Straße (Neukölln)

The concept area Neukölln / Rixdorf lies in the Borough of Neukölln on the south eastern border of the city (Großer Hundekopf - Great Dog's Head). The size of the concept area is 6,2 square km. It encompasses three almost parallel radial roads Hermannstraße, Karl-Marx-Straße and Sonnenallee as well as tangential connections to Treptow (Pannierstraße, Wildenbruchstraße). In the north-west the area is limited by Hermannplatz (Hermann Square), in the South by the urban highway A 100.

According to the land use plan the concept area Neukölln / Rixdorf has a dense residential use around Sonnenallee, a mixed use structure in Hermannstraße and mixed uses and a concentration of retail stores in the area of Karl-Marx-Straße.

The concept road Karl-Marx-Straße lies in the centre of the concept area and comprises the area between Reuterstraße in the North and Saalestraße / S-Bahn (interurban train) line in the south. The concept road has a length of 1,7 km. The business street with a high percentage of services is classified as a federal highway B 179 and is a major radial road to the city.

The land use plan zones Karl-Marx-Straße with its buildings as an area with predominant mixed uses with a concentration of retail stores. Albert Schweizer School lies nearby in the South.

The concept area Neukölln / Rixdorf stands as an example for a central, densely built area that is highly exposed to tangential and radial traffic. The extension of the federal highway A 100 can contribute to relieve the tangential connections, but the stronger exposed radial roads will not be relieved by this infrastructural measure.

A management and design conception was developed for Karl-Marx-Straße, the concept road sector lying in the centre of the area, which is part and parcel of the all over strategy for the concept area and is aligned with the concerted planning proposals. These envisage a one-lane passenger car routing and the installation of bicycle facilities on the road lane. The plans for the reconstruction of Karl-Marx-Straße will reduce noise considerably and improve the use of the road space.

The measures on Karl-Marx-Straße have to be seen in connection with the concept area Neukölln / Rixdorf considering their effects on traffic and their consequential effects on noise development.

A reconstruction or scaling down of Karl-Marx Straße with a strong reduction of its capacity cannot be recommended on terms of noise reduction, because this would mean to shift traffic noise to other likewise highly exposed roads, or to the subordinate traffic net.

For further roads in the concept area Neukölln / Rixdorf there is a description of measures that can contribute to a short-term reduction of noise exposure and to an improvement of the conditions for all traffic modes.

Further planning proposals are presented as middle and long-term options (Stage 2) for the concept area that consider the implementation of the reconstruction of Karl-Marx-Straße and its resulting requirements.

■ **Illustration 20 Concept Area Neukölln / Rixdorf and Concept Road Sector Karl-Marx-Straße with Proposals for Short-term Measures**

■ Table 24 Concept Area Neukölln / Rixdorf und Concept Road Karl-Marx-Straße – Proposals for Short-Term Measures (Stage 1)

Traffic Management in the Area		
Speed Regulations		
①	Flughafenstraße	Reducing maximum speed allowed to 30 km/h at night (planned / being implemented)
②	Hertastraße	
Traffic Management Measures		
③	Hertastraße	Installing a ban on lorry traffic to its avoid noise disturbances (in connection with the existing lorry-driving-ban Silbersteinstraße)
Road Space Measures		
④	Lahnstraße	Reconstructing the road and installing bicycle facilities (within the program Stadtumbau West (Urban Redevelopment West))
⑤	Erkstraße	Road surface renewal (Planned)
⑥	Karl-Marx-Straße	Remodelling the street, taking into account the recommendations for noise reducing planning, installing bicycle facilities (optional bicycle strips on road lanes)

Effects on noise

Noise exposure can be reduced in many roads if the following proposed short-term measures are put into practice:

- The proposals for the remodelling of Karl-Marx-Straße, developed for this preliminary plan and adopted by the noise action plan can contribute to a relevant improvement of the organisation and presentation of Karl-Marx-Straße and will have a noise reducing effect though slowing down and steadying traffic flow and bundling traffic into the middle of the road lane. The noise reductions sum up to 2 dB(A), together with the recommended introduction of Tempo 30 regulations up to 6 dB(A). Traffic shifts and minor increases of noise in the northern section of Sonnenallee are linked with this (by up to 0,5 DB(A)).
- The envisaged short term road surface renewals in Erkstraße and in Lahnstraße lead, together with linear measures, to a level reduction of up to 2 dB(A).
- The installation of Tempo 30 at night in Flughafenstraße and in Hertastraße now being implemented, can reduce noise exposure by 3 dB(A) during the night.
- The ban on lorries enacted in the Air Pollution Control Plan in Silbersteinstraße and the proposed complementing lorry traffic ban on Hertastraße lead to noise reductions of 1 dB(A) in these streets.

After bringing into operation the urban highway A 100, a long-term traffic relief can be expected that may also lead to perceptible noise reductions. The highest noise reductions are expected in Saalestraße (up to 3 dB(A)), in Lahnstraße (up to 2 dB(A)) and the northern section of Karl-Marx-Straße (additionally up to 2 dB(A)). In Sonnenallee there will be an increase in noise values that can be compensated by road space measures.

The implementation of Tempo 30 regulations, for which studies are recommended, can attain considerable noise reductions. Combined with linear measures these allow noise reductions by up to 6 DB(A).

It is also recommended to implement further locally focussed measures to attenuate source and target traffic through parking area management.

5.6.12 Concept Area Ober- and Niederschöneide (Treptow – Köpenick)

The concept Area Ober- and Niederschöneide lies in the borough Treptow-Köpenick in south-eastern Berlin. The south west border of the area is the axis of the federal highway B 96a (Schnellerstraße – Michael-Brückner-Straße), the point farthest North is the traffic junction Edisonstraße / An der Wuhlheide. The concept area is separated into a southern (Niederschöneide) and a northern part (Oberschöneide). In the north-south direction it is divided by the succession of streets Karlshorster Straße / Siemensstraße and Spreestraße / Edisonstraße.

The concept area stands as an example for highly exposed outskirts with tangential and radial traffic that should be relieved by complementary road net connections. Here, in Ober and Niederschöneide, the south east connection SOV, to be finished by 2015 is important.

Medium-term concepts that allow a relief of the traffic axes in the concept area after the realisation of the southeast connection, are dominant within the noise reduction plan for Ober and Niederschöneide. A relevant aspect is an efficient deviation of traffic through organisational measures. These are supported by modifications of the distribution of the road space on the former thorough roads and they will be complemented by the renewal of the streetcar lines in the area. Additionally, short-term measures for the southeast of the area can be implemented independently from the realisation of the southeast connection.

■ **Illustration 21 Concept Area Ober-and Niederschöneide with Proposals for Short-term Measures**

The following short-term measures are recommended for the concept area Ober- and Niederschöneide:

■ **Table 25 Concept Area Ober- and Niederschöneide Proposals for Short-Term Measures (Stage 1)**

Organisational Traffic Measures		
Traffic Development		
①	Siemensstraße between Edisonstraße and Wilhelminenhofstraße	Reduction of the maximum allowed speed to 30 km/h at night (Planned / being implemented)
②	Fennstraße south of Schnellerstraße	
③	Schnellerstraße between Hasselwerder Straße and Britzer Straße	
④	Spreestraße / Edisonstraße / Siemensstraße	Increased speed controls
Road Space Measures		
⑤	Schnellerstraße east of Fennstraße	Marking of bicycle facilities (bicycle strips / optional strips)
⑥	Fennstraße south of Schnellerstraße	Shifting parking from the footpath to the road lane (on one side)
⑦	Michael-Brückner-Straße, northern side	Marking of a parking strip (2008 after opening A 113)

Effects on noise

Putting into practice short term measures, can reduce noise exposure especially in the southeast area of Ober- and Niederschöneweide.

- Through the regulation of Tempo 30 at night now being implemented in Schnellerstraße, Fennstraße and Siemensstraße) the noise disturbance can be reduced during the night by 2 – 3 dB(A).
- With the recommended linear road measures in Schnellerstraße and Fennstraße to reduce the width of road lanes, the speed level can be reduced and the traffic flow steadied.
The steadying of traffic flow has a noise reducing potential of up to 2 dB(A) at Tempo 30, at Tempo 50 the steadying of traffic flow can reach approximately 1 dB(A)⁷⁰
The reduction of braking and accelerating activity linked to the steadying of traffic contributes to a reduction of peak levels.
- The steadying of traffic and speed reduction combined with Tempo 30 at night have a noise reducing potential of up to 5 dB(A)
- The installation of a parking strip in Michael-Brückner-Straße can increase the distance of the road lane to the buildings. A reduction of up to 1 dB(A) can be attained by this measure.

With the envisaged extensions to the road net and the complementary developed measures, high reductions of noise exposures that can lead to an improvement of the situation on the present thorough roads in the middle to long- term are possible. Together with the renewal of streetcar rails and a refurbishment of road spaces, level reductions of up to 10 dB(A) can be reached.

On the other roads in the concept area the potentials for noise reduction are somewhat lower. Here long-term traffic volume reducing measures will be necessary to improve the noise situation.

Even if all measures are implemented and long-term reducing potentials are provided for, still high noise exposures will remain in parts of the concept area. Therefore the possibilities for passive noise protection measures should be assessed.

5.6.13 Concept Road Section Baumschulenstraße (Treptow-Köpenick)

The concept road Baumschulenstraße lies in the Borough of Treptow-Köpenick, in the district Baumschulenweg (south eastern outer urban area). This road section, which is part of a tangential connection and an access road to the Federal Autobahn A 113 over the access Späthstraße, runs from Köpenicker Landstraße in the northeast to Südostallee (Southeast-Avenue).

The Baumschulenstraße stands as an example for a tangential connection with an average traffic exposure in a densely built narrow road. Due to the business activities in it, it has to fulfil high requirements for pedestrian traffic and amenity.

A basic relief of Baumschulenstraße isn't possible within the time-frame of the Noise Action Plan (this will only be possible in the long-term with the construction of the central sector of SOV – after 2015). Within the Noise Action

⁷⁰ Steadying of traffic flow is not included in the calculation of noise levels (according to VBUS), independently the influence of traffic development on noise levels has been proved in several studies (see, among others Umweltbundesamt (Federal Environmentl Office) , Handbuch Lärminderungspläne (Handbook Noise Reduction Plans), Berlin 1994. it will be taken into account in the following presentations.

Plan the point is to show, considering the traffic functions that will still be necessary in the middle term, the possibilities of noise reduction that provide for the requirements of the uses of the area.

Noise reduction planning for the concept road sector Baumschulenstraße focuses on interim solutions for road space measures that should have a provisional character in view of the long term withdrawal of traffic and the then possible remodelling of Baumschulenstraße.

The measures should be implemented in the middle term – if possible with the realisation of the 1st section of the southeast connection SOV (Südostverbindung).

In the long-term (after 2015) Baumschulenstraße can be relieved of 50 % of its present traffic volume with the 2nd section of the southeast connection between Markgrafenbrücke (Markgrafen Bridge) and the southern end of Baumschulenstraße.

■ **Illustration 22 Concept Road Section Baumschulenstraße with Proposals for Short-term Measures**

In the short term the reduction of maximum allowed speed to 30 km/h at night is envisaged

■ **Table 26 Concept Road Sector Baumschulenstraße – Proposals for Short-Term Measures (Stage 1)**

Organisational Traffic Measures		
Traffic development		
1	Baumschulenstraße between Köpenicker Landstraße and Sonnenallee	Reduction of the maximum allowed speed to 30 km/h at night (Planned / being implemented)

Effects on Noise

In the short term the installation of Tempo 30 at night in Baumschulenstraße between Köpenicker Landstraße and Sonnenallee can reduce the noise level by 2 to 3 dB(A) during the night.

With measures yet to be assessed for the middle term (road space measures, expansion of Tempo 30 at daytime) a noise reduction between 4 and 5 dB(A) can be attained.

In the long term (after 2015) the noise levels can be reduced by further 3 dB(A) through a traffic reduction (with the realisation of the 2nd stage of the southeast connection).

5.6.14 Concept Area Frankfurter Allee Nord (North) and Concept Road Section Frankfurter Allee (Lichtenberg)

The concept area Frankfurter Allee Nord and the included concept road section Frankfurter Allee lies in the borough of Lichtenberg, on the eastern border of the city (Großer Hundekopf / Large dog’s head).

The area comprises the town quarter between Mierendorffstraße in the West and Zentralfriedhof (Central Cemetery) Friedrichsfelde /the railway line in the East. Frankfurter Allee is the southern, Bornitzstraße is the

northern border. The concept road section Frankfurter Allee comprehends the area from the S-Bahn- (interurban train) Station Frankfurter Allee to Rosenfelder Straße.

The concept area Frankfurter Allee Nord stands as an example for an mixed uses area with dwellings and working locations, in which the noise problems result primarily from access traffic (passenger car traffic and streetcar) and small scale thorough traffic. Large scale thorough traffic is only dominant in the marginal areas.

The concept road section Frankfurter Allee stands as an example for a major radial road with very high traffic exposure and connecting functions. Fundamental traffic reductions cannot be expected.

The approach of noise reducing planning in the area are focussed on following aspects:

- Small scale traffic shifts to relieve especially sensitive areas as well as
- Road space measures
 - To support the traffic shifts
 - To increase the distance between traffic and the built-up areas and
 - To attenuate the speed level

Approaches to a low noise redesign on Frankfurter Allee are delineated.

Additionally to the envisaged Tempo 30 regulations at night, it is recommended to include selected roads beyond the major road net into the Tempo 30 zones.

To avoid traffic noise the promotion of the environmental network and passenger car target traffic reduction, for example through mobility management by the local companies, should be supported.

Pending on other plans, middle- to long-term rail and road surface renewals are proposed.

- **Illustration 23 Concept Area Frankfurter Allee Nord and Concept Road Section Frankfurter Allee with Proposals for Short-Term Measures**

The following short-term measures are recommended for the concept area Frankfurter Allee Nord and for the concept road section Frankfurter Allee:

■ Table 27 Concept Area Frankfurter Allee Nord and Concept Road Section Frankfurter Allee – Proposals for short-term Measures (Stage 1)

Traffic Control and Freight Traffic Routing at Junctions		
①	Siegfriedstraße / Josef-Orlopp-Straße	Rerouting through traffic to Josef-Orlopp-Straße / Ruschestraße / Möllendorffstraße / ... Adjustment of the junctions to the aimed at traffic routing (Adjusting LSA)
②	Josef-Orlopp-Straße / Ruschestraße	
③	Ruschestraße / Frankfurter Allee	
Organisation of Traffic in the Area		
④	Alfredstraße	Removing of parking strips from the foot path. Shifting of parking areas to the road lanes.
Speed Regulations		
⑤	Alfredstraße / Schottstraße / Atzpodienstraße / Rüdigerstraße / Siegfriedstraße north of Rüdigerstr.	Reducing the maximum allowed speed to 30 km/h at night (Planned / being implemented)
⑥	Siegfriedstraße south of Rüdigerstraße	Integration into Tempo 30 Zone (in the Responsibility of the Borough)
⑦	Gudrunstraße between Fanningerstraße and Frankfurter Allee	
⑧	Alte (Old) Frankfurter Allee	
Road Space Measures		
⑨	Alfredstraße	Installation of bus stop capes for all bus stops (Planned)
⑩	Rüdigerstraße	Installation of a traffic island
⑪	Ruschestraße (already planned)	Installation of bicycle facilities
⑫	Frankfurter Allee, westl. Möllendorffstr. (already planned / being implemented)	
⑬	Atzpodienstraße	
⑭	Frankfurter Allee / junction area with Rosenfelder Straße	Refurbishment of the junction within the Replacement Construction Program 200872009 for the LSA Frankfurter Allee/Rosenfelder Straße. Installation of bicycle facilities.

Effects on Noise

The noise exposure in the surveyed area will diminish when the short-term measures are put into practice:

- The establishment of Tempo 30 at night in Alfredstraße, Schottstraße, Atzpodienstraße, Rüdigerstraße and in the northern Siegfriedstraße now being implemented, can reduce noise exposure during the night by 2 – 3 dB(A).
- In the southern Siegfriedstraße and in Gudrunstraße for which an inclusion into Tempo 30 zone is recommended, a reduction of noise by 2 – 3 dB(A) during the whole day can be attained.
- The short-term road space measures in Alfredstraße and Atzpodienstraße separating the noise source from the buildings, will have positive acoustic effects somewhat under 1 dB(A).

- In Atzpodienstraße the combination of an envisaged speed limitation (Tempo 30 at night) with the steadying of traffic resulting from the reduction of the width of the lanes, can attain noise reductions of approx. 5 dB(A) (at night together with Tempo 30). With the installation of bicycle facilities the conditions for bicycle traffic will be improved.

The developed measures can attain considerable reductions of noise exposure, without intervening substantially into the traffic functions of the major road net.

Further noise reductions in the area would be possible with long-term measures to reduce the traffic volume.

The development of measures for the concept road section Frankfurter Allee has showed that in this highly exposed major radial road there are scarce potentials to reduce noise effectively. Even if the recommended road space measures were implemented, high noise disturbances will still remain. For Frankfurter Allee measures for passive noise protections should be additionally studied.

5.6.15 Concept Area Residenzstraße (Reinickendorf)

The selected concept area Residenzstraße lies in the Borough of Reinickendorf in the outer town (in the Agglomeration). In the West the concept area extends to Aroser Allee, in the East unto the limit of the Borough of Pankow.

The northern limit runs closely above the road line Lindauer Allee – Klemkestraße. The southern limit is the limit of Mitte Borough, to which the concept area Reinickendorfer Straße (see 5.6.1) is directly attached to.

The federal highway B 96 on the road line Lindauer Allee – Residenzstraße, Provinzstraße and Aroser Allee runs as a radial road connection to the city across the concept area. Emmentaler Straße, Holländerstraße and Klemkestraße are the most important tangential roads of the city.

The concept area between Aroser Allee, Lindauer Allee / Klemkestraße, Provinzstraße and the limit of the borough is characterized by residential use, it is interspersed with retail stores and several noise sensitive institutions.

The concept area Residenzstraße stands as an example for a transit space within the suburb with a high percentage of thorough traffic that cannot be shifted elsewhere. The spectrum of measures within the Noise Action Planning is therefore limited to measures of traffic management and road space design.

The focus lies on measures to improve the road space and to improve the conditions for non-motorised traffic, especially the completion and improvement of bicycle facilities and the improvement of the accessibility and use of bus stops. Additionally it is recommended to assess the possibilities of reducing the maximum allowed speed to 30 km/h during the whole day in the long run in selected roads, using the experiences won by the now being implemented regulations for Tempo 30 at night.

■ **Illustration 24 Concept Area Residenzstraße with Proposals for Short-Term Measures**

The implementing of Tempo 30 regulations at night and the renewal of noisy road surfaces are recommended as short-term measures

■ Table 28 Concept Area Residenzstraße – Proposals for Short-Term Measures (Stage 1)

Measures for Traffic Organisation		
Traffic Flow		
①	Klemkestraße between Sommerstraße and Emmentaler Straße	Reducing the maximum allowed speed to 30 km/h at night (Planned / being implemented)
②	Residenzstraße/Kopenhagener Straße between Lindauer Allee and Flottenstraße	
③	Emmentaler Straße between Aroser Allee and Reginhardstraße	
④	Provinzstraße between Kühnemannstraße and Holzstraße	
Road Space Measures		
⑤	Holländerstraße between Brienzer Straße and Residenzstraße	Renewal of the road surface on one side (Planned / being implemented)
⑥	Holländerstraße between Aroser Allee and Brienzer Straße	Renewals of road surfaces on both sides (Planned / being implemented)
⑦	Pankower Allee between Residenzstraße and Provinzstraße	
⑧	Klemkestraße between Kopenhagener Straße and St. Marienkirche	Replacement of pavement on the road lanes (when funding is clarified)
⑨	Klemkestraße between Emmentaler Straße and S-Bahn (interurban train)	Road surface renewal (within the investment planning from 2009 onwards.)

Effects on noise

The implementation of the following short-term measures will reduce noise exposure in the surveyed area Residenzstraße considerably:

- The establishment of Tempo 30 at night now being implemented (in Klemkestraße, Kopenhagener Straße, Emmentaler Straße and Provinzstraße) will reduce the noise exposure during the night by 3 dB(A)
- In Klemkestraße (section from Kopenhagener Straße to St. Marien Church) the noise exposure can be reduced by up to 3 dB(A) by replacing the cobble pavement by asphalt.
- The renewal of damaged asphalt surfaces (in Aroser Allee already implemented, envisaged for Pankower Allee and Holländer Straße and recommended for Klemkestraße between Emmentaler Straße and S-Bahn (interurban train), allows a noise reduction of an average of up to 1 dB(A), additionally peak levels will be reduced, thus mitigating the annoyance for the dwellers.

The developed middle to long-term measures can attain a considerable reduction of noise exposure, without intervening into the traffic functions of the major road net.

The main focus is on measures to improve the road space and to improve the conditions for non-motorised traffic, especially the completion and improvement of bicycle traffic facilities and the improvement of the accessibility and use of bus stops. Additionally it is recommended to assess the possibilities to reduce the maximum allowed

speed to 30 km/h during the whole day in the long run for selected roads, using the experiences won by the now being implemented regulations for Tempo 30 at night.

Even if all measures were implemented and taking into account long-term reduction potentials, noise disturbances will still remain in parts of the area high. For these areas measures for passive noise protections should be assessed.

5.7 Planning of Measures for Exemplary Road Sections

A further detailed study of planning measures will be shown for four exemplary road sections in the concept areas with the objective to prepare an exemplary implementation of possible noise reducing road measures.

■ **Table 29 Exemplary Roads for Intensified Study of Road Space Measures within Noise Reduction Planning**

Borough	Exemplary Road Sections
Mitte	Prinzenallee from Pankstraße to Osloer Straße
Mitte	Drontheimer Straße from Osloer Straße to Ritterlandstraße
Friedrichshain-Kreuzberg	Dudenstraße from Mehringdamm to Kolonnenbrücke / Bezirksgrenze
Charlottenburg-Wilmersdorf	Brandenburgische Straße from Berliner Straße to Hohenzollerndamm

The following typical conflict situations for Hot Spot sections emerge in the exemplary road sections

- Very high noise exposure and many people affected
- Passenger car traffic determines the road space strongly
- Unsatisfactory conditions for bicycle traffic
- Problems of direct noise exposure due to a too short distance between the buildings and the road lanes
- Unfavourable relation of road lanes to the total road space

The goal of the intensified studies for planning proposals is:

- Elaboration of possible and/or necessary steps to prepare the implementation of the measures and
- Short-term, possibly interim implementation of measures with accompanying surveys to assess the effects of the measures.

■ **Illustration 25: Sections of the Exemplary Roads, Status-quo**

<p>■ Brandenburgische Straße between Sächsische Straße and Gasteiner Straße</p>	<p>■ Drontheimer Straße in the Section Osloer Straße to Soldiner Straße / Ritterlandweg</p>
<p>■ Prinzenallee in the Section Badstraße to Osloer Straße</p>	<p>■ Dudenstraße between Katzbachstraße and Methfesselstraße</p>

The exemplary roads were chosen because typical, repeatedly proposed measures can be studied in depth in them. These are:

- Reduction of many lanes to one extra large lane in both directions (Brandenburgische Straße, Dudenstraße and Prinzenallee),
- Reduction of extra large road lanes (Drontheimer Straße),
- Installation of an optional strip for bicycle traffic (all roads)
- Installation of traffic islands (Dudenstraße).

To prepare their implementation the following steps were carried out:

- Elaboration of preliminary drafts in the scale 1:500 with proposals for solutions for road sections and intersections
- Estimate of the effect on traffic and presentation, as the case may be, of shifting of passenger car traffic. Where required, references are made to necessary verification (with the new traffic model).
- Verification of the capacity of traffic junctions and road sections according to “Handbuch für die Bemessung von Straßenverkehrsanlagen (HBS)” (Handbook for the dimensioning of facilities for road traffic), for the status quo and planning case, respectively.
- Representation of the effects of planning on the following concerns:
 - public transport
 - Bicycle and pedestrian traffic
 - parked vehicles / delivery traffic
 - Traffic security
- Representation of the noise reductions with the envisaged measures
- Representation of the costs for the measures in the trial period, as well as other cost relevant factors

■ Table 30 Concept for the Implementation of Exemplary Road Sections (Stage 1)

Organisation of the Road Space – Exemplary Road Sections	Road Sections - Measures
Exemplary test of refurbishing measures for four exemplary road sections	<p><u>Prinzenallee</u> between Badstraße and Osloer Straße Construction of two extra large one-lane surfaces Marking of optional bicycle strips</p> <p><u>Drontheimer Straße</u> between Osloer Straße and the borough border: Narrowing the road lanes Resetting the bus strip in parts Marking of optional bicycle strips Installation of bicycle traffic facilities</p> <p><u>Dudenstraße</u> between Mehringdamm and Kolonnenbrücke (Kolonnen Bridge) / borough border Construction of two extra large road lanes Marking of optional bicycle strips Installation of traffic islands</p> <p><u>Brandenburgische Straße</u> between Hohenzollerndamm and Berliner Straße Construction of two extra large one-lane surfaces Marking of optional bicycle strips</p>

■ Illustration 26 Sections of the exemplary road sections, Planning proposals

<p>■ Brandenburgische Straße between Sächsische Straße and Gasteiner Straße</p>	<p>■ Drontheimer Straße - Road Segment Osloer Straße to Soldiner Straße / Ritterlandweg</p>
<p>■ Prinzenallee - Road Segment Badstraße to Osloer Straße</p>	<p>■ Dudenstraße between Katzbachstraße and Methfesselstraße</p>

The results of the implemented plans for the exemplary road segments show that the proposals for measures can be realised in the short term and with a low budget. An adequate capacity for the road segments as well as for the intersections could be verified. An improvement of the traffic flow and a perceptible reduction of noise after the implementation of the measures are expected.

The conditions for the other traffic modes could also be improved.

Therefore it is recommended to remodel the four exemplary road segments with provisional measures and to document and evaluate the experiences and results of their operation in practice.

The following accompanying surveys in the form of a before-after analysis are suggested:

- To investigate the traffic exposure on the road sections and at the intersections (passenger cars and bicycles) and, where appropriate, to study shifting traffic to other roads
- To record the speed at daytime / at night
- To assess traffic flow
- To record the operation schedules of bus traffic
- To make inquests of dwellers regarding noise perception
- To evaluate accidents

In case of a positive appraisal of the provisional reorganisation of the exemplary roads, it is recommended to implement further road space measures similar to those described in the reports about concept areas and concept road segments.

The recommendations for measures on the four exemplary segments based on the elaborated detailed plans should be provisionally implemented.

The test of eligible road space measures to reduce noise should be accompanied by an assessment of their effects.

The effects of road space measures on traffic volume, actual speed, traffic flow and noise exposure should be assessed by "before-after" surveys.

The documentation of the surveys of the exemplary segments is available in the papers for the action planning.

5.8 Effect Analyses and Cost-Benefit Analyses

5.8.1 Effects of Measures Plan Case LAP (Noise Action Plan) 2012

The effect analyses are based on the short term measures of the measure catalogue 2012 according to Chapter 5.6 in the concept areas or along the concept road sections.

The effects of these measures are displayed with the planning case LAP 2012 that sums up the quantifiable effects of existing planning as well as the developed and coordinated measures for the concept areas and road sections and evaluates them as to their effects on noise.

Effect analyses show the expectable development of noise exposure and noise concernment, if the existing planning and short term measures are implemented. In addition, the quality- indicator-system elaborates the synergies of the measures.

Effect Analyses for Traffic

The traffic forecast for the short term measures 2012 doesn't only take into account the measures in the concept areas but also further changes in the road net that are scheduled or presumably realised between 2005 (the year of the analysis) and 2012.

The traffic volumes assessed 2005 will be updated to the year 2012 in the "traffic model Berlin" taking into account the envisaged infrastructural and organisational traffic measures.

Changes of traffic exposure in the concept areas can be attained by only a few short term measures. These are delineated in Chapter 5.6.

Effect Analyses for Noise and People Affected

For the planning case 2012 the calculations of noise exposure from passenger cars consider

- The assessed traffic volume of the planning case 2012
- Recommendations for measures regarding traffic organisation and road space and
- Speed reduction

Furthermore the following short term measures for streetcars are considered (see also Chapter 6.3):

- Replacement of the large composite slabs and installation of NBS in the conflict areas according to the 1st priority step,
- Realisation of grass rails according to the 1st priority step

The essential factors for the calculation of the noise effects of passenger car traffic are the traffic volume, speed, the lane surfaces and the situation in the streets as to the distance of the buildings to the lanes. The steadying of traffic flow, aimed at with the road measures, allows for with a reduction of the noise level⁷¹

The following table shows the effect of measures on noise exposure based on the exceeding of threshold values in the concept areas or in the concept road sections for the analysis and the planning case 2012.

A detailed description of the measures can be found in the reports for the concept areas. Each short term measure and their effects on noise are described in Chapter 5.6 of the noise action plan.

⁷¹ The steadying of traffic flow is not taken into account for the assessment of noise values (according to VBUS and RLS90). Still, the influence of the kind of driving on noise levels has been proved in several surveys (see also Umweltbundesamt, Handbuch Lärminderungspläne, Berlin 1994) and therefore it will be taken into account

■ Table 31 Development of noise exposures – Exceeding of the threshold value of the 1st stage

Borough	Surveyed net Concept Areas / Concept road sections	Exceeding of threshold values 70 / 60 dB(A)							
		In km section sides				in % of the section lengths			
		Analysis day / night		Planning case 2012 day / night		Analysis day / night		Planning case 2012 day / night	
Mitte	Reinickendorfer Straße	8,6	23,7	7,4	22,2	29	80	25	74
	Beusselstraße	1,4	2,1	1,4	2,1	67	98	67	98
Friedrichshain- Kreuzberg	Boxhagener Viertel	1,6	5,8	1,0	3,2	14	53	9	30
	Mehringdamm / Gitschiner Straße	5,0	15,0	4,9	14,3	18	54	18	51
Charlottenburg- Wilmersdorf	Mierendorffinsel	0,5	4,0	0,1	3,1	5	36	1	28
	Wilmersdorf / Uhlandstraße	5,1	23,2	3,5	15,4	12	53	8	35
Spandau	Wilhelmstadt	5,1	9,8	5,0	7,7	39	74	38	59
Steglitz- Zehlendorf	Steglitz / Schloßstraße	9,0	18,1	7,7	15,1	31	62	26	52
Tempelhof- Schöneberg	Tempelhof	11,3	17,1	10,9	14,9	47	71	45	62
	Potsdamer Straße	4,0	4,4	3,4	4,3	89	97	75	94
Neukölln	Neukölln-Rixdorf / Karl-Marx-Straße	15,9	29,9	13,9	28,4	44	82	38	78
Treptow- Köpenick	Ober- und Niederschöneeweide	7,4	11,2	6,0	9,6	51	77	41	66
	Baumschulenstraße	1,7	2,3	1,7	2,1	73	95	73	86
Lichtenberg	Frankfurter Allee Nord / Frankfurter Allee	3,5	8,3	2,3	6,0	31	73	20	52
Reinickendorf	Residenzstraße	4,7	12,1	4,1	11,0	24	60	21	55
Total / Average value for all Concept areas /-sections		84,8	187,0	73,3	159,5	38	71	34	61
Difference Analysis / Planning case 2012 for all concept areas /-sections				-11,5	-27,5			-4%	-10%

The limit value of the 1st Stage of 70 dB(A) at daytime is exceeded in 73,3 km of built up section sides (33,7%) in the concept areas and road sections in the planning case LAP 2012. In the analysis it was 84,8 km (38,3%). At night the limit value of 60 dB(A) is exceeded on 159,5 km (60,6%) of the built up road sections in the concept areas and road sections. In the analysis the percentage was 71,0%.

With the short term measures in the concept areas the values in each concept area can be reduced at daytime by a maximum of 14% (Potsdamer Straße) and at night by up to 23% (Boxhagener Viertel) reaching values below the limit value of the 1st stage. In the average, the exceeding of the limit values of the 1st stage can be reduced by 4% (at daytime) and 10% (at night).

The development of people harmfully affected (with exposures above sanitary limits) can be demonstrated by the sum of the LärmKennZiffern (LKZ) (noise index) for the concept areas respectively on the concept sections for the analysis and for the planning case LAP 2012.

The short term measures can reduce the number of persons harmfully affected in the sum of all concept areas by 9% at daytime and by 13 % at night.

Especially in Boxhagener Viertel (26% reduction of the persons affected at night) and in Wilhelmstadt (24% reduction of persons affected at night) the short term measures envisaged can attain very high relief.

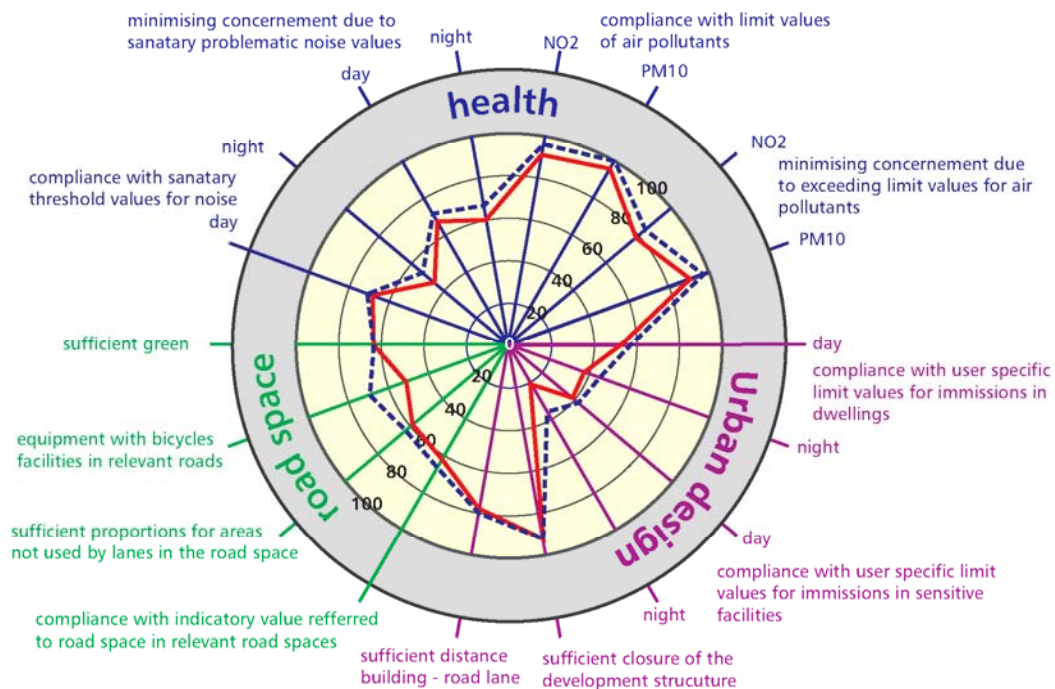
■ **Table 32 Development of persons affected – total of noise indexes 65 at daytime / 55 at night**

Borough	Survey net Concept area / concept road sections	Total LKZ according to concept area / section 65 at daytime / 55 at night			
		Analysis at daytime / at night		Planning case 2012 at daytime / at night	
Mitte	Reinickendorfer Straße	37.960	70.708	36.244	66.611
	Beusselstraße	3.611	6.428	3.475	6.298
Friedrichshain- Kreuzberg	Boxhagener Viertel	9.435	20.261	8.000	14.963
	Mehringdamm / Gitschiner Straße	23.808	48.164	22.673	46.355
Charlottenburg- Wilmersdorf	Mierendorffinsel	4.699	10.969	4.072	10.352
	Wilmersdorf / Uhlandstraße	30.278	62.981	24.574	48.874
Spandau	Wilhelmstadt	14.342	26.507	14.185	20.094
Steglitz- Zehlendorf	Steglitz / Schloßstraße	20.499	38.405	18.630	33.602
Tempelhof- Schöneberg	Tempelhof	25.375	39.328	24.224	33.577
	Potsdamer Straße	8.541	12.567	7.191	11.210
Neukölln	Neukölln-Rixdorf / Karl-Marx-Straße	46.522	77.814	44.000	73.359
Treptow- Köpenick	Ober- und Niederschöneweide	13.822	21.900	11.779	17.779
	Baumschulenstraße	4.712	7.691	4.664	5.676
Lichtenberg	Frankfurter Allee Nord / Frankfurter Allee	15.050	28.929	12.319	22.371
Reinickendorf	Residenzstraße	16.511	29.001	15.312	26.121
Total of all Concept areas/ sections		275.165	501.654	251.342	437.241
Difference Analysis / Planing case 2012 for all concept areas / sections Absolute numbers				-23.823	-64.413
Difference Analysis / Planning case 2012 for all Concept areas / sections in %				-9 %	-13%

Quality Indicator System Effect Analysis

The images of the effects in the quality Indicator System show the synergies of the noise reducing measures.

- Illustration 27 Before-After Comparison in the “target spider” quality indicator system planning case 2012 and the analysis 2005. Total of all concept areas and sections



The short term measures and the evaluations related to them (e.g. persons affected and the abundance of limit values for specific uses) can attain definite improvements of noise exposure at night

Especially the measures to steady passenger car traffic flow have a positive influence on air pollution. Together with the current developments in the area of air pollution (motor pool, background exposure) a reduction of pollutants can be attained.

There are important synergies between noise reducing measures and neighbouring fields of action for road measures. The equipment of streets with bicycle facilities is very important; there are a number of positive interdependencies with strategic measures for bicycle traffic.

5.8.2 Costs of the Measures

The recommended short term measures of the Noise Action Planning are mostly part of existing planning and/or measures funded by other institutions, that are already foreseen in the investment planning financed by other programs.

Because of the high noise reduction synergies with other plans, cost for noise reduction can be kept comparatively low, if these synergies are used.

■ Table 33 Costs of the Short-Term Measures According to Concept Areas

Borough	Concept Area/concept Road section	Costs Total in Th. €	Financing from Investment planning/ existing Programs	Financing within LAP
Mitte	Reinickendorfer Straße	206,4	155,0	51,4
	Beusselstraße	0,0	0,0	0,0
Friedrichshain-Kreuzberg	Boxhagener Viertel	1.208,3	1.208,3 ⁷²	0,0
	Mehringdamm / Gitschiner Straße	542,0	397,4	144,6
Charlottenburg-Wilmersdorf	Mierendorffinsel	350,0	--	350,0
	Wilmersdorf / Uhlandstraße	4.917,2	4.849,6	67,6
Spandau	Wilhelmstadt	9,5	8,0	1,5
Steglitz-Zehlendorf	Steglitz / Schloßstraße	65,1	45,1	20,0
Tempelhof-Schöneberg	Tempelhof	42,2	8,4	33,8
	Potsdamer Straße	9.530,0	9.530,0	0,0
Neukölln	Neukölln-Rixdorf / Karl-Marx-Straße	6.124,4	6.123,2	1,2
Treptow-Köpenick	Ober- und Niederschöneeweide	20,1	3,6	16,5
	Baumschulenstraße	4,0	4,0	0,0
Lichtenberg	Frankfurter Allee Nord / Frankfurter Allee	263,1	197,0	66,1
Reinickendorf	Residenzstraße	2.866,0	2.766,0	100,0
Total for all concept Areas/Concept Road Sections		26.148,3	25.295,6	852,7

Constructive measures in roads and the basic renewal of damaged road lanes are attached to high costs. In Boxhagener Viertel there will be also costs for the renewal of rails. Many cost intensive measures are already financed or part of existing investment plans.

Traffic organisation measures that can be implemented by signposting and markings are rather low cost. The proposed measures in the noise action plan are mostly in this category.

The renewal of noisy road lanes (cobblestones, concrete blocks) in the concept areas Mierendorffinsel and Residenzstraße and the implementation of the four exemplary road sections in the concept areas Reinickendorfer Straße, Mehringdamm and Wilmersdorf imply higher costs, which have to be financed by the noise action plan.

The costs resulting from the noise action plan can be evaluated judging the effectiveness of the costs (cost effectiveness analysis, see Chapter 5.8.3), these have to be against the monetary benefits of the measures of the noise action plan, which can be assessed by a cost-benefit analysis (see Chapter 5.8.4)

⁷² incl. Renewal of streetcar rails in Boxhagener Straße, cf. also Chapter. 6.3; according to statements from BVG the renewal for one section is decided as soon as there is a decision about their remainder

5.8.3 Cost effectiveness Analysis

The cost effectiveness analysis shows the height of financial means that can attain a certain amount of noise mitigation. The mitigation effects are described by the decrease of people affected, expressed by the LärmKennZiffer (noise index) (LärmKennZiffer LKZ at night >55 x AW). The costs for the implementation of Noise Action Planning are set against the decrease of people affected (LKZ). Based on this, the average amount of money in Euro that is necessary to relieve one dweller by one dB(A) starting from 55 dB(A) at night (= 1 LKZ) can be shown.

■ Table 34 Cost-Effectiveness-Comparison based on the noise index (LKZ Basis 55 at night)

Borough	Concept area / section	LKZ-Reduction Analysis / Planning case 2012 at night		Implementation costs noise reducing measures in Th. €		Cost effectiveness in € / LKZ-reduction at night	
		abs.	Diff. in %	Total	Percentage LAP	Total	Percentage LAP
Mitte	Reinickendorfer Straße	4.098	6%	206	51	50	13
	Beusselstraße	130	2%	-	-	-	-
Friedrichshain-Kreuzberg	Boxhagener Viertel	5.298	26%	1.218	-	230	-
	Mehringdamm / Gitschiner Straße	1.809	4%	542	145	300	80
Charlottenburg-Wilmersdorf	Mierendorffinsel	617	6%	350	350	567	567
	Wilmersdorf / Uhlandstraße	14.106	22%	4.917	68	349	5
Spandau	Wilhelmstadt	6.413	24%	10	2	2	-
Steglitz-Zehlendorf	Steglitz / Schloßstraße	4.803	13%	65	20	14	4
Tempelhof-Schöneberg	Tempelhof	5.751	15%	42	34	7	6
	Potsdamer Straße	1.357	11%	9.530	-	7.022	-
Neukölln	Neukölln-Rixdorf / Karl-Marx-Straße	4.455	6%	6.124	1	1.375	-
Treptow-Köpenick	Ober- und Niederschöneide	4.121	19%	20	17	5	4
	Baumschulenstraße	2.014	26%	4	-	2	-
Lichtenberg	Frankfurter Allee Nord / Frankfurter Allee	6.558	23%	263	66	40	10
Reinickendorf	Residenzstraße	2.881	10%	2.866	100	995	35
Total resp. Average value for all Concept areas / sections		64.412	13%	26.148	853	406	13

The average for all concept areas is the sum of 13 €, which are necessary to relieve one dweller by 1 dB(A). Depending on the mixture of measures, these values fluctuate considerably:

- A sum below 10 € per inhabitant and dB(A) can be realised especially in those concept areas in which noise reduction can be attained with organisational or simple road space measures (e.g. Ober- and Niederschöneweide, Steglitz)
- Very high costs, also referred to the mitigating potentials, result from road lane renewal measures (e.g. Mierendorffinsel).

5.8.4 Cost-Benefit-Analysis

The cost-benefit-analysis faces the costs of the Noise Action Planning against possible monetary benefits arising from the implementation of the measures with the expected noise reduction. The monetary benefit results from the reduction of the external costs of noise exposure.

External costs of noise

Noise exposures lead to many negative effects with high external costs. The economic costs of traffic noise arise especially from health risks. Beyond this, real estate value losses are relevant for the monetary evaluation of noise exposure in several surveys.⁷³

Health risks

Cardiovascular illnesses and psychological disturbances (stress reactions, sleep disturbances) are health disturbances coming from noise. The health disturbances lead to treatment costs and loss of production. Surveys about the overall economic costs of cardiovascular illnesses and the proportion indebted to noise⁷⁴ show the health costs due to traffic noise. In an evaluation according to Schmedding / Schaffer⁷⁵ for example, annual costs of € 130 for each person exposed to noise values higher than 65 dB(A) are attributed to road traffic noise. Internal calculations of the Federal Environment Agency⁷⁶ showed an annual value of 39 € / dB(A) for high exposure values over 65 dB(A).

An estimation of health costs due to noise in the survey net of the noise action plan Berlin based on both describe approaches shows costs of 29 million € to 35 million €.

The different values result from the difference between a flat rate estimate of values above 65 dB(A) and an evaluation by dB(A) steps. In the concept areas the assessed health costs lie between 8,1 Million € and 10,8 Million € per annum.

Rental and real estate losses

Additionally to the economically relevant health risks, reduced incomes from rents and real estate sales can be observed. Studies regarding reduced rental incomes show an average of 0,9% rental reduction per dB(A) in

⁷³ z.B. Schmedding / Schaffer in Zeitschrift für Lärmbekämpfung: Monetäre Bewertung von Lärminderungsszenarien, Nr. 5, 2005, S. 142 - 147

⁷⁴ see also Weinberger, M., Thomassen, G., Willeke, R.: Kosten des Lärms in der Bundesrepublik Deutschland, Umweltbundesamt Berichte 9/91, Berlin 1991 und INFRAS, IWW: external Costs of Transport, März 2000

⁷⁵ Schmedding / Schaffer, l.c.

⁷⁶ internal calculations of The Federal Environmentl Office (2003) based on a Study by Infrac, IWW: „External Costs of Transport“.

places with 50 dB(A) and more⁷⁷. The Berlin rent index also assumes a rebate on rent, however, starting from higher noise exposures. The published studies name real estate losses with 0,5% of the value per dB(A) starting from 50 dB(A). In the roughly estimated assessment of rental and real estate losses in the surveyed net of the noise action plan, specific Berlin data (sizes of dwellings, rents, real estate prices) were included as far as available. The assessed values are reference values, they have to be evaluated considering the comparability of the points of departure, for instance in the real estate sector.

Using the mentioned approaches, rental losses up to approximately 110 million € per annum⁷⁸ and real estate losses of approximately 1.550 million € were estimated for the most exposed streets in Berlin (in the surveyed net). In the concept areas the rent losses reach up to 24,5 Mio € per annum, the real estate losses up to 345 million €.

Rental losses and real estate value losses affect the tax revenues. Thus costs for the general public are generated in form of tax losses. A calculation of these costs for the general public depend on further factors, that can't be assessed within the noise action plan. Therefore we abstain here from a fiscal evaluation of rental and real income losses.

■ **Table 35 Compilation of the costs for noise in Berlin (total survey net) and in the concept areas (Based on the noise map 2005)**

Approach	Costs per item / basic assumptions	Noise costs for Berlin / in the Concept areas (rounded up to hundred)
Health costs from	130 € per highly exposed Inhabitant (LDEN > 65 dB(A)) and annum ①	29.494.400 € / annum 8.116.800 € / annum
	39 € per dB(A) und highly exposed inhabitant (LDEN > 65 dB(A)) and annum ②	34.719.600 € / annum 10.822.900 € / annum
Rental losses from	1,80 €/sq. Mtr. Per annum for Lnight > 55 dB(A) ③	19.161.900 € / annum 4.364.400 € / annum
	0,5 €/sq.mtr. per dB and annum (ab 50 dB(A)) ④	110.370.000 € / annum 24.522.500 € / annum
Real estate losses	Assuming 1.300 €/sq.Mtr. real estate value and real estate losses of 0,5% (ab 50 dB(A)) ⑤	1.550.568.800 € 344.513.000 €

① Evaluation after Schmedding / Schaffer: Monetary Evaluation of Noise Reducing Scenarios, in.: Zeitschrift für Lärmbekämpfung Nr. 5, 2005

② Internal calculations of the Federal Environment Agency (2003) based on the Infrac survey, IWW: "External Costs of Transport", March 2000

③ Approach of the Berlin rent index: rebate for exposures >65 dB(A) at daytime / >55 dB(A) at night: of the 20 % margin between the average rent and the lower margin; the calculations were based on an average rent of 4,75 €/sq.m., a possible noise rebate of 0,15 €/sq.m. and an average size of dwellings of 38,8 sq.m. per inhabitant. Furthermore a rate of self used residential property of 10%⁷⁹ is assumed

⁷⁷ Cf. in summary in: Schmid, Stephan A., Externe Kosten des Verkehrs: Grenz- und Gesamtkosten durch Luftschadstoffe und Lärm in Deutschland (External traffic costs: limit and total costs through air pollutants and noise in Germany), Stuttgart 2005

⁷⁸ The assessed value according to the rent index lies considerably below this; considering the generalised approach of the rent index and the total rental losses, not listed in the rent index, e.g. including vacancies, this is estimated as too low.

⁷⁹ From: empirica by order of Bundesgeschäftsstelle Landesbausparkassen: Einkommen und Vermögensbildung in Deutschland, (income and asset formation in Germany) Sonderauswertung der EVS 2003. Vermögensbildung und Wohneigentum . Wohneigentum in der Geschosswohnung – Berlin July 2007

- ④ Assuming a rental rebate of 0,9 % per db(A) (starting from 50 dB(A) at daytime) based on several Swiss studies⁸⁰ (rents, size of dwellings and rate of residential property see ③)
- ⑤ For real estate prices see also Berliner Morgenpost 09.25.2008; assuming a loss of real estate value of 0,5% starting from 50 dB(A) based on several studies (see also footnote 79) and the comments in WertV (Verordnung über Grundsätze für die Ermittlung der Verkehrswerte von Grundstücken) (Directive regarding the basic assumptions for the assessment of market values of realties) §5

Cost-Benefit Considerations

The foregoing descriptions of the costs of noise with respect to health and real estate matters, show that a comprehensive evaluation of the external costs of noise and the monetary advantage of reducing noise exposure always bear uncertainties. Besides the problem of the margins of the described evaluations, there are categories of uses whose monetary values can't be sufficiently taken into account and there are other benefits of noise reduction, for instance in real estate, that possibly have impacts on the market but cannot be correctly described within noise reducing planning.

A summarised evaluation of costs of noise and the benefits attained by noise reduction can be made, based on a factor recommended by a working group of the EU-Commission for a monetary evaluation of road traffic noise. A brain trust working on the social economic aspects of noise, submitted a recommendation in December 2003.⁸¹

Allowing for existing uncertainties, the paper recommends a cost-effectiveness of 25€ per dB (Lden) per household and year for the evaluation of the reduction through street noise.

This value describes the willingness to pay for a reduction of noise exposure. The willingness-to-pay-approach is one of several possible monetary evaluation methods. Being a subjective approach, it is oriented on the individual preferences of persons and describes the price people would be willing to pay, to attain a certain situation (e.g. silence at night).⁸²

According to a study of the Federal Environment Agency, this value is applicable for a limit value between 45 and 55 dB(A)Lden⁸³.

The **monetary benefit of the noise action plan Berlin** is based on the recommended evaluation approach of the European Commission.

- An evaluation is made for the benefits attached with the noise reduction by short-term measures in the concept areas
- Per dB(A) reduction and relieved household, starting from a noise level of 50 dB(A) (day), the 25 € recommended by the EU-Commission are estimated as monetary benefit
- With the attainable noise reductions in the concept areas and on the concept road sections with a total of 42.400 households⁸⁴ a monetary benefit of 425.000 € per annum can be assessed, according to the evaluation criteria of the EU-Commission.

⁸⁰ see also Schmid, Stephan a.: External traffic Costs, Limit and total costs by air pollutants and noise in Germany

⁸¹ Valuation of noise, Position Paper of the working group on health and socio-economic aspects, 4. Dezember 2003

⁸² see also Schmedding/Schaffer, ibid

⁸³ see also Umweltbundesamt: Praktische Anwendung der Methodenkonvention: Möglichkeiten der Berücksichtigung externer Umweltkosten bei Wirtschaftlichkeitsrechnungen von öffentlichen Investitionen(Federal Environment Agency:Practical application of the convention for methods: Possibilities to allow for environmental costs for economic calculations of public investments), Forschungsprojekt im Auftrag des Umweltbundesamtes, FuE-Vorhaben Förderkennzeichen 203 14 127, April 2007; für den Lärmaktionsplan Berlin wird ein Schwellenwert von 50 dB(A) angenommen.

⁸⁴ The number of households was assessed based on an average household size for Berlin of 1,8 persons/household, calculated from the persons living on the surveyed net, cf. Statistic Year Book Berlin 2007

To attain the benefit of 425.000 € per annum with noise reducing measures, in addition to the already planned measures a singular sum of 850.000 € for noise reducing short term measures has to be raised. Taking into account the monetary benefits stipulated by the EU-Commission, an economic amortisation of the measures can be attained within 2 years.

The described monetary benefits of Noise Action Planning of 425.000 € are based on the day values of noise exposure⁸⁵. Taking into account the higher noise reductions at night – especially by the implementation of the Tempo 30 concept – the real benefits are higher. Further benefits coming from the improvement of the amenity and the better use of road space, e.g. the installation of bicycle traffic facilities are not considered, so that it can be assumed that the described benefits are lower than the real benefits of Noise Action Planning.

5.9 Passive Sound Protection Concept Module

Even after the implementation of the short term noise reducing measures (planning horizon 2012), a number of Hot Spot sections remain, in which for the time being, it is not possible to take measures to avoid, shift or reduce noise pollutions or that will still be highly exposed even after the implementation of measures road sections. Road sections in which also in the future the threshold values of 70 dB(A) at daytime / 60 dB(A) at night (1st stage) are exceeded, are eligible for passive noise protection measures (e.g. sound proof windows, sound absorbing fans) to protect the people affected.

Passive sound protection measures can at least protect the interior spaces of dwellings effectively from noise. Contrary to the active noise control of sources, such as noise barriers and noise protection walls as well as surface renewals, passive sound protection acts for the locations in which the noise arrives, in the buildings.

Passive sound protection measures are especially appropriate to guarantee night recovery of the people affected, because they offer protection from high peak levels. These measures allow a quiet and healthy living even on very noisy roads.

The enclosing component parts (windows, doors, roller shutter cases, walls, roofs) of a building should be improved in such a way, that the interior levels in noise sensitive rooms of 40 dB(A) at daytime and 30 dB(A) at night⁸⁶ are not exceeded. The installation of sound proof ventilating equipment supports the effect of the measures.

The improvement of the enclosing component parts has the additional effect that as a rule, they also improve the thermal insulation of the buildings. Thus there is the possibility to use the synergies of noise insulation / thermal insulation. This should be taken into account in view of the Energy Saving Directive.

Sound Proof Window Program

To reduce the number of affected people in dwellings, an overall program for sound proof windows for the town should be set up. A program for sound proof windows for Berlin will need to have a considerable volume to be able to distribute effectively and justly subsidies for passive noise protection. The requirements for subsidies should be similar to those in the directive for traffic noise protection on federal highways of the Federal Republic (VLärmSchR 97). The most important ones are listed as follows:

- The threshold values of the 1st stage of 70 dB(A) at daytime and 60 dB(A) at night have to be exceeded,

⁸⁵ The EU recommends the application of Lden

⁸⁶ „Rooms in need of protection“ according to the specifications for noise renovation as determined by the guidelines for the protection of traffic noise on federal highways (VLärmSchR 97)

- The rooms to be protected are used exclusively or mainly to live in, teach, to nurse sick or elderly people
- The estimated number of dwellings and windows⁸⁷ affected by exceeding threshold values in the planning case are listed in the following table:

■ **Table 36 Berlin total – Affected Dwellings and Windows, Planning case 2012**

Levels in dB(A)	Dwellings*	Windows*
> 70 dB(A) at night	900	3.000
> 65 bis 70 dB(A) at night	30.200	105.000
> 60 bis 65 dB(A) at night	148.100	513.100

(*rounded up in hundreds)

The assessment of the necessary funds for a program for sound proof windows is based on the following assumptions:

- price of a sound proof window per sq.m. 472,00 €⁸⁸
- average size of a window 2,5 sq.m
- percentage of windows in rooms used at night 50%
- price per unit for a sound absorbing fan 500,00 €⁸⁹
- sound absorbing fans per dwelling 2

Under the assumption of a refunding of 75% of the necessary measures, according to VLärmSchR 97, and an implementation rate of 25%⁹⁰ the following costs for passive sound protection measures were assessed:

■ **Table 37: Berlin total – Cost estimation of passive noise protection measures, Planning case 2012, Cost assumptions according to VLärmSchR 97**

Levels in dB(A)	Costs for windows	Costs for fans	Total costs
> 70 dB(A) at night	331.875,-	168.750,-	500.625,-⁹¹
> 65 bis 70 dB(A) at night	11.615.625,-	5.662.500,-	17.278.125,-
> 60 bis 65 dB(A) at night	56.761.688,-	27.768.750,-	84.530.438,-
Total	68.709.188,-	33.600.000,-	102.309.188,-

The implementation of a program for sound proof windows, due to the high costs, has to be carried out step by step depending on the noise exposure and the people affected. It has to be ensured that the most exposed roads are selected first, and that no measures to avoid, shift of reduce noise exposures are possible. This means for the

⁸⁷ Source: Berlin noise map

⁸⁸ Source: Noise protection statistics on Federal Highways 2006, German Federal Ministry of Transport, Building and Urban Development

⁸⁹ ibid

⁹⁰ The implementation rate is an average value from several noise renewal programs in Germany. It takes into account, that not all buildings are liable for subsidy, the owners don't fill the applications for subsidy or there are already sufficient noise proof windows.

⁹¹ The sections with night levels > 70 dB(A) in 80% of the cases are near urban expressways, which already have undergone a noise renewal. The necessary costs to implement the first stage of a program for sound proof windows could be reduced to 100.000 €.

Berlin major traffic road net that first of all major access roads and axes are to be considered for subsidies for measures for passive noise protection. This should be possible with 100.000 € (see footnote 75).

Depending on the available future funds for a program for sound proof windows the following implementations steps are considered:

- 1st implementation step: highly exposed major traffic roads of the survey net, in which no measures to reduce levels can be implemented
- 2nd implementation step: highly exposed major traffic roads of the survey net, that will still be highly exposed after noise reducing measures are implemented,
- 3rd implementations step: major traffic roads of the survey net, exceeding levels of the 1st stage of 60 dB(A) at night, in which no measures to reduce levels can be implemented
- 4th implementation step: remaining major traffic roads of the survey net exceeding levels of the 1st stage of 60 dB(A) at night.

The implementation steps should guarantee that first of all the most exposed road sections with low potentials to reduce noise levels in the Berlin major traffic road net should be protected by passive noise protection measures.

The Example of the Program for Noise Proof Windows of the Town of Düsseldorf

Unlike noise renewal according to VLärmSchR 97, the municipal program for sound proof windows of the town of Düsseldorf supports passive sound protection measures in established renewal areas with flat-rate subsidies⁹² for sound proof windows and sound absorbing fans. Based on the "Master plan noise", especially exposed road sections are selected, in which no measures to avoid, shift of reduce noise pollutions are possible or in which even after implementing noise reducing measures exposure is extremely high. By now whole town quarters are established as renewal areas.

The budget funds for the implementation of the Düsseldorf program for noise proof windows are 500.000,- € for 2008 and a similar sum is planned for the following years.

The drawing on the program funds show that there is a great demand on the side of the affected persons. If a federal support program comes about, the Land Berlin should offer a similar co-financed master plan.

Assessment of the possibility to provide funds for a program for noise proof windows with the objective to support passive sound protection measures on the most exposed road sections, especially to protect night silence – using synergies with the Energy Saving Directive.

⁹² A maximum of 225 € per sq.m. sound proof window and 225 € per noise absorbing fan is subsidised

6 Concepts for Local Rail Traffic in the Town (Streetcar and Subway)

6.1 Need for Action

The local rail traffic (streetcar and above-ground subway) is an important generator of traffic noise following road traffic and railway traffic (on the nets of Deutsche Bahn and S-Bahn (interurban train) in Berlin (see also chapter 3.1). Considering rail traffic in relation to its transport performance (in terms of persons per km), it is clear that local rail traffic as to noise exposure of the population, is rather a part of the solution than part of the problem.

Still, there are locations in the town in which streetcars and subways generate high noise disturbances and in which the potentials to reduce noise are not yet exhausted. This is especially relevant, because the acceptance of these traffic modes and their possible expansion are important for a further shift of passenger car traffic to public transport.

Due to the planning approach (people affected and measures per road sections, consideration of overall levels), the average levels described here adopt the results of the traffic noise map of the sections (calculations according to Schall03) and not the levels of the strategic noise map (calculations according to VBUSch⁹³)⁹⁴. Conform to its rules and standards a so called 'rail bonus' is applied on the traffic noise map that consists of a level discount of 5 dB(A), due to the assumed lesser subjective noise disturbance from rail traffic. In the strategic noise map (after VBUSch) this rail bonus is not applied. The levels of the strategic noise map for rail noise are therefore higher than those of the traffic noise map. To be able to compare the results, the rail bonus was not taken into consideration for the measures planned for the local rail traffic.⁹⁵

Even after the implementation of the "Noise Renewal Program for Streetcars" in Berlin from 2002 to 2005, 54 Hot Spot segments remain, in which

- The threshold values of the 1st stage with 70 dB(A) at daytime / 60 dB(A) at night are exceeded
- The streetcar is an equally strong emitter as passenger cars
- The noise index (LKZ) N55 is > 250

Altogether, on these 31 km 17.000 persons are affected by overall noise levels (streetcar and passenger car traffic) between 62 and 78 dB(A) at daytime and 57 to 73 dB(A) at night.

Primarily, those segments of above-ground subway traffic are to be examined, which appear as elevated train viaducts and run between residential buildings (Subway lines 1 and 2). In these areas due to the proximity of the adjoining buildings and also due to the construction technique, high exposures occur through droning bridge components and squeaking curves. The maximal levels lie between 61dB(A) and 70 dB(A) at daytime and between 58 and 64 dB(A) at night. The areas concerned are 3.4 km long and 1.000 persons are affected.

The number of people affected and the not yet utilized noise reducing potentials make it clear, that to make these traffic means more acceptable, it is necessary to develop a noise rehabilitation program.

⁹³ Provisional calculating method for the environmental noise of railways, VBUSch 2006

⁹⁴ See also –Chapter 3.4

⁹⁵ Due to the different parameters (Number of trains, length of trains, correction factor for the large composite panels) the average levels here and those on table 32 can differ from the results of the strategic noise map.

6.2 Possible Measures and their Priorities

The measures to reduce noise can be classified into three categories:

- Measures for the rail systems
- Measures concerning vehicle technology
- Measures concerning service management

The measures were planned, discussed and coordinated within an accompanying team with representatives of the Senate Administration, BVG (Berlin public transport administration), the Federal Environmental Office and the TU (Technical University) Berlin. The detailed documentation of the planned measures is enclosed in the materials for the Action Plan⁹⁶.

The ranking of the priorities for the recommended measures is made according to

- The current noise exposure (overall > 70 dB(A) / 60 dB(A)),
- the percentage of rail traffic on the overall exposure (with at least equally strong pollutions),
- the people affected (dwellers, LKZ),
- the possible noise reduction and
- the cost-effectiveness of each measure (Euro per habitant and dB reduction)

Three priority steps were set up for the Noise Action Planning:

- 1st priority step: Measures that reduce the overall level by at least 3 dB(A) in the most exposed areas (LKZ > 600), as well as measures in areas with a noise exposure of > 65 dB(A) at night which are to be renovated by the BVG in the short term.
- 2nd priority step: Measures that will reduce the overall level by at least 2 dB(A) in eminently high exposed areas (LKZ >400)
- 3rd priority step: Measures that will reduce the overall level by a minimum of 1 dB(A) in highly exposed areas (LKZ > 250).

Within these three priority steps the measures will be classified in respect to the people affected in each section (LKZ).

6.3 Recommendations for Effective Short Term Measures

To reduce the noise created by local rail traffic the Action Plan recommends to make a Noise Renovation Plan that encloses with priority measures that can be implemented in the short term, if financing is provided and they will lead to a noise reduction in the most exposed areas. It is also recommended to find solutions for further noise reducing measures within pilot projects, so as to be able to apply these in the middle term.

⁹⁶ See Report regarding local rail traffic

The following measures are recommended as a part of the noise renovation plan for local trains (see also Table 32):

- replacement of the large composite slabs and installation of the New Berlin Streetcar Rails (NBS) in the conflict areas according to the 1st priority step,
- implementation of grass rails according to the 1st priority step,
- replacement of the switch frog points especially in the conflict areas,
- pilot project noise mitigating curb of the above-ground subway (e.g. U1 between Kottbusser Tor and Wassertorplatz),
- pilot project rail absorber of the elevated train (e.g. Schlesisches Tor and Bülowstraße),
- pilot project mini-noise barrier for the streetcar (e.g. Müggelheimer Straße in Köpenick).

The short term measures can reduce noise exposures in the concerned conflict areas by up to 5 dB(A) and approx. 4.600 affected persons can be relieved. The costs sum up to approx. 4,9 Million Euro⁹⁷.

■ **Table 38 Short term Measures (Local Rail Traffic)**

Road Section	Railway embankment	Rating Level up to in dB(A)		Rating Level Tramway* up to in dB(A)		Rating Level Motorcar up to in dB(A)		LKZ 55 up to ... at night	Dwellers Affected	Measure	Reduction in dB(A)	Costs in Euro	Efficiency [Euro per Affected Person and dB(A)]
		daytime	at night	daytime	at night	daytime	at night						
Hohenschönhauser Straße / Oderbruchstr. from Oleanderstr. to 200 east of O.-Marq.-Str.	SA + GVP	67	63	67	63	60	53	1577	447	Green Track	5	1.488.000	666
Invalidenstraße from Brunnenstr. to Chausseestr.	SA partly. NBS	75	70	73	68	72	66	1435	362	NBS	2	841.500	1162
Bahnhofstraße from Parrisusstr. to Annenallee	SA	74	69	72	68	69	62	1187	435	NBS	2	680.000	782
Wendenschloßstraße from Luisenstr. to Müggelheimer Str.	SA / EGM	76	70	71	69	74	64	1074	220	Green Track	5	480.000	436
Schillerstraße from Dietzgenstr. to Charlottenstr.	GVP + SAP	72	68	71	67	65	57	972	310	Replacement GVP / NBS	4	1.011.500	816
Rennbahnstraße from Berliner Allee to Parkstr.	GVP	73	67	71	64	69	63	777	229	Replacement GVP / NBS	3	603.500	878
Grabbeallee from Pfeilstr. to Pastor-Niemöller-Platz	GVP	73	69	72	68	67	61	775	490	Replacement GVP / NBS	4	1.360.000	694
Karl-Lade-Straße / Anton-Saefkow-Platz from Landsberger Allee to Paul-Junius-Str.	GVP partly. SO	67	63	66	63	58	50	694	934	Replacement GVP / NBS	4	1.054.000	282
Bölschestraße from Müggelseedamm to Fürstenwalder Damm	GVP	73	68	70	67	69	60	684	454	Replacement GVP / NBS	4	1.615.000	889
Boxhagener Straße from Warschauer Str. to Colbestr.	GVP + SA	72	65	68	63	70	60	650	525	Replacement GVP / NBS	3	1.207.000	766
Stahlheimer Straße from E.-Weinert-Straße to Kuglerstraße	GVP	73	69	71	69	69	62	631	62	Replacement GVP / NBS	3	229.500	1234
Berliner Straße from S+U-Bahn Pankow to Schulstr.	GVP	76	72	75	70	71	66	586	136	Replacement GVP / NBS	3	425.000	1042

⁹⁷ The measures marked gray in Table 32 are already planned for implementation by BVG. Therefore their costs were not considered within the mentioned overall costs of the Action Plan.

7 Further Noise Sources

The Noise Reducing Planning also deals with noise exposure coming from aircraft and rail traffic as noise sources, in addition to road traffic, streetcars and above-ground subway traffic.

7.1 Aircraft traffic

Aircraft noise is essentially different from the so far reported noises. It is emitted from above and cannot be mitigated outside the buildings. The problem areas are generally limited to the neighbourhood of the airports, because noise exposure is generated by starting and landing aircrafts.

Currently the Land Berlin has two airports – Tegel and Tempelhof. A further airport: Schönefeld, lies directly next to the border. This airport will be developed to be the new capital airport (Berlin-Brandenburg International) up to 2011. Both internal airports Tegel and Tempelhof will be closed in return. The number of people affected by aircraft noise (equivalent permanent sound level: 60 dB(A) at night) will then be reduced by more than a half in the whole Region Berlin/Brandenburg. So far these sound levels by the airports Tegel and Tempelhof alone affect 62.000 persons.

After the development of Schönefeld to BBI Airport with a final capacity of 30 million passengers per annum the numbers of persons affected will be 26.000⁹⁸.

It has to be pointed out, that the calculation according to the Law of Protection Against Aircraft Noise differs from the procedure of the strategic noise mapping. The $L_{Aeq, Tag}$ according to the aircraft noise law is a daytime value (6.00 am to 10.00 pm).

The all day value L_{DEN} includes also the night time exposure with a higher weighting due to the higher disturbances.

This is the reason for the differences in the number of persons affected in Chapter 3.1.

All in all there is almost no difference.

In the planning approval procedures (Planfeststellungsverfahren) for the development of Schönefeld Airport measures to reduce aircraft noise exposure will be determined. The effects on the Berlin Area, considering the Aircraft Noise Amendment, till 2009 can only be assessed after the completion of the procedures.

The aircraft noise exposure in Berlin at the time being is as follows:

Tempelhof Airport

The number of aircraft movements on Tempelhof Airport lies considerably under the threshold of 50.000 aircraft movements per annum specified for aircraft noise exposure mapping in the 34th BImSchV. Air traffic will shortly be discontinued due to the annulment of the operating licence by October 31st 2008 by the Senate Administration for Urban Development⁹⁹. The aircraft noise disturbances for the neighbours will therefore end shortly.

⁹⁸ Concerted Development Plan, Location Development of the Airport LEP FS as amended on May 30th 2006, released by the Department for Infrastructure and Regional Planning Brandenburg and the Senate Administration for Urban Planning, <http://gl.berlin-brandenburg.de/imperia/md/content/bb-gl/landesentwicklungsplanung/lepfs.pdf>

⁹⁹ The referendum „Tempelshof must stay as an airport“ failed on April 27th 2008.

Tegel Airport

Tegel Airport will be closed six months after the start of BBI. The strategic noise maps show a high noise exposure in the area of the landing and starting lanes of the airport. In the past considerable noise control measures have been taken¹⁰⁰.

Sound Proof Windows

Acoustic glazing was promoted from 1970 to the middle of the 90ies – according to the legal regulations - in particularly exposed areas. Nowadays the replacement of windows is supported financially by the Kreditanstalt für Wiederaufbau KfW (Reconstruction Loan Corporation).

Operating Restrictions

- Tegel has a night flight ban from 11 pm to 6 am. Postal night flights, rescue flights and special flights subject to authorisation as well as unavoidable late landings with a tolerance of one hour are exempted. These exceptions, restrictively handled and controlled by the aeronautical authorities, are subject to additional dues.
- The dues are graded according to the noise developed by the aircrafts. The classification is based on the measured starting and landing noise levels of the previous year. This is an incentive for the airlines to pilot the Berlin Airports with modern and low-noise aircrafts.
- All stands for clearing are electrically equipped. Therefore the turbines for energy production can be disconnected in large parts. This contributes to a reduction of carbon dioxide and an avoidance of bad smell in the proximity of the airport and last not least to a reduction of noise during the low traffic and quiet times of the day at the airport.

Currently the airport is implementing further noise reducing measures:

- A pilot project proved that the exposure of a residential area near Hohenzollern Canal can be reduced by the increased use of the southern lane for landings. This will now be considered for the current operation of the airport.
- A noise barrier will be erected to protect the adjoining residential area Cité Pasteur. It will shield the noise from the aircrafts trafficking at ground level.

As the possibilities to reduce noise at Tegel Airport are practised and the airport will be closed in 2011, no extra measures are being developed in the Noise Action Plan.

Schönefeld Airport / Berlin-Brandenburg-International BBI

Schönefeld Airport is not included in the strategic noise maps of Berlin. For this the Senate Administration for Health, Environment and Consumer Protection would have had to refer to noise maps of Brandenburg. As the number of flights during the year 2004 (under review) lay below the prescribed number of 50.000¹⁰¹, the State of Brandenburg abstained from noise mapping. The necessary data for a noise map of Schönefeld could not be given to us so that the state of Berlin was not able to handle it.

¹⁰⁰ Environmental statement 2007, Berlin airports – Berlin-Schönefeld Airport GmbH, www.berlin-airport.de, March 2008

¹⁰¹ In 2005, before mapping, all major noise sources had to be assessed. The procedure for the assessment is regulated by law. It is based on the traffic figures for the year before (2004). In 2004 the number of flights lay below the prescribed limit of 50.000. therefore the State of Brandenburg did not order the making of strategic noise maps. It was assured though, that in the future Schönefeld will be included in the noise mapping. In 2010, based on the traffic volume of 2009, this noise source will be reported to the Federal Environment Ministry

The noise exposure will be assessed within the existing planning and authorisation procedures, it will be controlled by the regulating authority and it will be published in the yearly aircraft noise reports. The noise exposure by the Schönefeld Airport for the Berlin population was assessed according to the mentioned data. An impairment of Berlin by a value higher than the valid limit values is not expected.

According to the legal requirements, a project approval procedure was made for BBI. At the time a plan extension procedure to readjust regulations especially for night flight traffic is in course. Its conclusion is expected for 2009.

Regulations for flight operations are provided for, such as an operating ban on noisy airplanes between 10 p.m. and 6 a.m. and a restriction on reverse thrust. Further included are regulations for engine trial runs to operations optimising of the landing strip use tending to reduce exposures during the night. The electric supply of the aircrafts is done with three stationary installed facilities and is extended by mobile facilities. The further instalment of stationary facilities is planned step by step. Passive noise protection measures and compensation regulations will take account of remaining adverse effects. Aircraft noise monitoring will allow the attribution of flight data. In addition there is a proviso to stipulate further requirements to protect the population in the future if this should be necessary.

The BBI noise protection will be regulated by a legal authorisation procedure. The Noise Action Plan does not replace its mandatory procedure or even confer a higher level of protection. Its task is to contribute to procure a noise reduction especially in situations where up to date there are no regulations to protect affected persons. Contrary to legal regulations for noise precaution, the Noise Action Plan has no limit values at its command that being exceeded, call for imperative intervention. Berlin has set itself limit values with the objective to locate the focuses of exposure and to make proposals to dispel or at least reduce them. This level of protection, which serves mainly to remedy existing noise exposures, cannot achieve the level of noise precaution for new developments or for substantial changes.

The exposures coming from BBI after its initial operation have been published in the current authorisation procedure. Accordingly, it cannot be assumed that the limit values of the Berlin Noise Action Plan will be exceeded in the Berlin urban area, taking into account its very high allowed noise exposure values of 70 dB(A) at daytime and 60 dB(A) at night.

The assessment of the people affected in the catchment area of the BBI can only be evaluated conclusively after the end of the extended plan approval procedure. Only then the aircraft noise exposure at night will be known, which is an important variable for the calculation of L_{den} . Within the updating of the Noise Action Plan the development of the aircraft noise exposure will be evaluated and if necessary, initiatives will be taken to reduce occurring disturbances.

7.2 Railway traffic

The traffic on nets of Deutsche Bahn and S-Bahn (interurban train) are the major originators of traffic noise after passenger car traffic.

The noises coming from railway traffic are classified in the noise types:

- Traction noises,
- Wheel – rails noises,
- Aerodynamic noises

Depending on speed, the total level is determined by one of these types of noise.

In the intra-urban areas there are locally higher noise levels from braking and curving noises due to frequent stops and narrow curves.

The results of noise mapping show, especially at night time, a high number of persons affected. Especially in the areas in which the Berlin limit values are exceeded (see Chapter 3) and high density coincide, there is a special need for action. These are among others:

- The dwellings along the Stadtbahn (interurban train) between Ostkreuz and Charlottenburg Station, for instance Hansaviertel, the areas around Savignyplatz, Alexanderplatz and Hackescher Markt,
- Köpenick, especially Friedrichshagen district,
- Spindlersfeld,
- Karower Kreuz (Junction)/ Karow district
- Westend / Olympiastadion
- Prenzlauer Berg, between Prenzlauer Allee and Schönhauser Allee,
- Nöldnerplatz,
- Grünauer Kreuz (Junction) / Alt Glienicke
- Karlshorst

Complaints of neighbours in the catchment area of the section between Grünauer Junction and Karower Junction show that freight traffic, especially during night time, is particularly disturbing. The rail stretch to Erkner is also highly exposed.

To reduce noise exposure technical measures on the rails and on the vehicles have to be considered. Further, noise barriers could attain a noise reduction for affected neighbours. The installation of sound proof windows can protect at least the living quarters from noise. Planning measures, e.g. the organisation of train operations, depend on the efficiency of the stretches and normally can't be realised.

The development and implementation of measures has to take into account that according to §47d BImSchG the setting up of the action plan falls into the jurisdiction of the local authorities, but as a rule DB AG (Deutsche Bahn) and S-Bahn Berlin are responsible for the implementation of measures.

Existing Measures for Noise Remediation on the Existing Berlin Net

A railroad noise remediation plan of the federal government exists since 2002. This program promotes voluntary noise remediation measures if the noise level exceeds the following values:

- Hospitals, schools, homes for the elderly, residential areas 70/60 dB(A) at day/night
- Central areas, central areas of suburbs, mixed used areas 72/62 dB(A) at day/night
- Industrial and enterprise areas 75/65 at day/night

The above named remediation values include the "rail bonus", i.e. a deduction of 5 dB(A) on the calculated noise levels. The rail bonus is based on former surveys and is based on the assumption that rail traffic noises are less disturbing than other noise sources with an identical sound level. The noise map according to the environmental noise directive does not include the bonus, because it considers only measured data and not subjective influences. To be able to make a remediation claim according to the Rail Noise Remediation Program of the

Federal Republic, a deduction of 5 dB(A) has to be made from the values of the strategic noise map, to be able to assess if the above named pollution levels are exceeded.

Until now primarily passive measures (mostly the installation of sound proof windows) have been state-aided in Berlin. The DB has a priority list, according to which noise remediation is subsidised. The priorities take into account the degree of the level exceedance and the population density. The program also lists focuses of exposure in Berlin, which according to today's state of knowledge will not be renewed before 2015.

The program plans the upgrading of freight trains to another brake system in the next years. The usual freight wagons use grey iron brake shoes that roughen the contact surfaces. These generate higher rolling noises. Therefore new brake shoes denominated K- or LL soles were developed. The potential for noise reduction compared with conventional brakes lies by 4 to 5 dB(A) relating to long-time average values. The upgrading is only effective if all the wagons in a train are endowed with the new brakes. Area-wide this will only be possible in 10 to 12 years¹⁰².

Furthermore it should be seen to it that this better technique is introduced all over Europe, because the mixture of foreign wagons without noise reducing techniques, even if their percentage is low, with the renewed German wagons, overlaps their noise mitigating effects.

During the last years pilot projects have been made to assess the possibilities of reducing noise exposure by S-Bahn through the development of technical noise reducing measures. These were initiated by the Berlin Senate and the Federal Environmental Office. The Berlin Technical University has analysed the S-Bahn series 481 between 2004 and 2006 to reduce the conspicuous drive noises that many people regard as disturbing.

The survey lists following reducing potentials:

- at a higher speed the installation of wheel-disc-absorbers has an effect of 2 dB,
- the sound deadening of the bogie frame also reduces 2 dB when starting and braking

The surveys showed that a constructive and thus necessary additional reinforcement of the motor flange reduces the drive noise¹⁰³. The analyses were accompanied and co-financed by S-Bahn Ltd.. The implementation of the measures was rejected among other reasons due to the costs (the installation of wheel disc absorbers for 500 vehicles amount to 4,5 million Euro). The S-Bahn Berlin argues that the sound deadening of the bogie frames as so far developed, might work in theory but the technical maintenance is not feasible.

Therefore the originally envisaged goal in the contract with the S-Bahn of a reduction of pollutions by at least 5 dB(A) was slightly missed; in the end, a consequent implementation of the developed measures would lead to a perceptible noise reduction. From the point of view of noise reduction the implementation of these measures would be desirable in the short term, especially taking into account that these vehicles will be used for the next 20 to 25 years. Therefore the Senate will continue to try to find a solution together with the S-Bahn GmbH.

Further Course of Action

Within the work on the Noise Action Plan, the Berlin Senate holds talks with representatives of the DB AG. These activities aim to identify concrete possibilities for measures to reduce rail noise. At first, these measures will have to be tested on adequate rail sections. The focus is on technical measures on the railroad, e.g. the application of

¹⁰² Bundesministerium für Verkehr, Bau und Stadtentwicklung (German Federal Ministry of Transport, Building and Urban Development): Flüsterbremsen zügig einführen - Pilotprogramm entlastet die Menschen an den Schienenstrecken schneller vom Lärm (Introducing whispering brakes soon – pilot program relieves people near railways from noise) , Pressemitteilung (Press release) Nr.: 365/2007 vom 30. November 2007 -

¹⁰³ Prof. Dr.-Ing. Markus Hecht, M. A. Christian Czolbe, Bericht 32/06 Reihenversuch Entdröhnung des Drehgestellrahmens der S-Bahn (Report 32/06 Test : Sound Deadening of the Bogie Frame of S-Bahn) BR-481, Berlin 15. Dezember 2006

rail absorbers. A test of this seldom proven technique could be possible on highly exposed locations. A positive vote from DB AG exists. It is subject to available funding and a test on experimental sections under operational conditions. A pilot test could be implemented in the middle term. Measures to reduce noise of freight trains by replacing the brakes are only effective in a long term.

Measures from the Rail Noise Renewal Program, such as noise barriers cannot be expected in Berlin in the short term, because the great number of people affected in other states of the Federal Republic only allow for a middle to long term implementation. The State of Berlin alone cannot carry out an extensive and short term reduction of rail noise disturbances without financial help from the federal government and without the support of DB-AG.

8 Quiet Areas

According to the Environmental Noise Directive, following the principle of prevention, “Quiet Areas in Agglomerations” are to be protected against an increase of noise¹⁰⁴. This guideline was adopted by German law in § 47d BImSchG (Noise Action Plans).

For the Analysis of quiet areas within the Noise Action Planning following work steps were carried out:

1. criteria for the selection of quiet areas in Berlin are to be defined that are oriented on the recommendations of the task group in the Länderausschuss für Immissionsschutz (Committee for Pollution Prevention) of April 2008
2. concrete quiet areas in Berlin are to be determined based on criteria previously defined within an iterative process
3. Strategies to protect quiet areas from a increase of noise

The detailed documentation of the above named steps is available as “Materials for the Noise Action Plan”. The relevant results are presented in the following chapter.

8.1 Criteria for the Selection of Quiet Areas in Berlin

The selection of Quiet Areas in Berlin has to:

- Comply with the requirements of the Environmental Noise Directive,
- Be ascertainable with the existing database in Berlin
- Comply with the (subjective) requirements of the persons searching recreation

This is the background for the definition in an iterative process of the criteria for selection represented in Table 39. The areas are differentiated in:

¹⁰⁴ Directive 2002/49/EG of the European Parliament and Council of June 25th 2002 relating to the assessment and management of environmental noise. The quiet areas in open country named there are not treated here.

- *Quiet areas in an agglomeration* according to the Environmental Noise Directive: are large continuous open areas, that allow sojourning and also long walks without crossing noisy areas
- *Urban recreation areas* that not necessarily have low noise levels, but possess a high sojourn quality in the neighbourhood of the dwelling locations and are large enough so that their core is considerably quieter than its periphery.

It has to be pointed out, that some quiet areas are crossed by important noise sources (Autobahn). This is true for the northern part of the Berlin Municipal Forest (1), the Grunewald (2), Tegel Forest (3), Düppeler Forest (6) and the Landscape Conservation Area Buch. There is no possibility to take measures to protect these areas due to the lack of financial means. For the expansion of the A 100, intended to relieve the inhabited inner city area, no noise insulation measures to protect the recreation areas will be funded by the road construction state agency.

■ **Table 39: Criteria for Selection** ¹⁰⁵

	Quiet Areas (Continuous Open Areas)	Urban Recreation Areas
Characteristic	Forest, green spaces, parks, fields, farmland and meadows. A continuous natural expanse connected with green spaces in the neighbouring landscapes	Green areas and recreation areas near residential areas within walking distance
Absolute limit level value ¹⁰⁶	$L_{den} \leq 55 \text{ dB(A)}$	--
Relative limit level value	--	-6 dB(A) in the core area in relation to the most exposed area
Limit value of extension	$\geq 100 \text{ ha}$	$\geq 30 \text{ ha}$

8.2 Quiet Areas in Berlin

Based on the abovementioned criteria for selection 11 quiet areas and 26 urban recreation areas were selected. These areas are described with their notation and size as follows:

- **Map 10 Quiet Areas in Berlin**

Quiet areas / Continuous Open Areas

These areas are predominantly the Landscape Conservation Areas and Nature Reserves and lie mostly in the outskirts. 11 continuous natural expanses comply with the criteria for selection¹⁰⁷.

¹⁰⁵ The criteria for selection are not to be understood as fixed threshold values. In individual cases they can be modified

¹⁰⁶ We propose this value as a threshold value for the selection of potentially quiet areas. It is not a goal value for planning. Planung.

■ **Table 40 Quiet Areas in Berlin (Continuous Natural Expanses)**

1	Berlin Municipal Forest (Treptow-Köpenick), incl. Landscape Conservation Area Erpetal and Neue Wiesen as well as the Nature Reserve Wilhelmshagen-Woltersdorfer Dünenzug	2.676 ha
2	Landscape Conservation Area Grunewald, incl. Nature Reserve Langes Luch, Riemeisterfenn, Barssee and Pechsee, Grunewaldsee, Postfenn, Sand Pit im Jagen 86 of the Grunewald, Teufelsfenn	3.063 ha
3	Landscape Conservation Area Tegeler Forest	1.435 ha
4	Landscape Conservation Area Tegeler Fließ, Blankenfelde and Lübarser Fields as well as Calcareous tuff area and Fen meadows near Tegeler Fließ,	1.335 ha
5	Landscape Conservation Area Düppeler Forst, incl. Nature Reserve Pfaueninsel, Großes Fenn and Bäkewiese	1.332 ha
6	Landscape Conservation Area Spandauer Forest and Eiskeller, incl. Nature Reserve Großer and Kleiner Rohpfehl and Teufelsbruch and Nebenmoore	1.250 ha
7	Landscape Conservation Area Buch incl. Bogenseekette / Lietzengraben lowland and Nature Reserve Karower Ponds	1.130 ha
8	Landscape Conservation Area Gatow, Kladow and Groß-Glienicke as well as Irrigation Fields Karolinenhöhe	1.090 ha
9	Landscape Conservation Area Müggelspreewiesen	102 ha
10	Schmöckwitzer River Island	590 ha
11	Landscape Conservation Area Wood Compound Frohnau	114 ha

Urban Green and Recreation Areas

Table 41 presents 26 urban areas that comply with the criteria for levels and sizes and have a high recreational function within walking distance to residential locations.

■ Table 41 Urban Green and Recreational Areas

12	Volkspark Wuhlheide and Surroundings	240 ha
13	Großer Tiergarten	210 ha
14	Landscape Conservation Area Volkspark Jungfernheide and Dauerwäldchen Siemensstadt	120 ha
15	Landscape Conservation Area Königsheide	107 ha
16	Landscape Conservation Area Pichelswerder and Tiefwerder Fields	97 ha
17	Landscape Conservation Area Kaulsdorfer Lakes	93 ha
18	Berlin* Zoo	92 ha
19	Britzer Garten*	90 ha
20	Landscape Conservation Area Plänterwald	90 ha
21	Landscape Conservation Area Köllnische Heide	90 ha
22	Landscape Conservation Area Falkenberger Irrigation Fields	85 ha
23	Treptower Park	84 ha
24	Landscape Conservation Area Volkspark Rehberge	78 ha
25	Recreational Park Marzahn*	70 ha
26	Landscape and Nature Reserve former Johannisthal Airfield	65 ha
27	Landscape Conservation Area Hönower Weiherketten	55 ha
28	Leisure Park Marienfelde	53 ha
29	Palace Garden Charlottenburg	53 ha
30	Volkspark Hasenheide	50 ha
31	Volkspark Friedrichshain	49 ha
32	Botanic Garden*	43 ha
33	Landscape Conservation Area Falkenberger Krugwiesen	42 ha
34	Volkspark Prenzlauer Berg	40 ha
35	Volkspark Wilmersdorf / Schöneberg	35 ha
36	Volkspark Humboldthain	30 ha
37	Schillerpark	30 ha

* Areas subject to entrance fees

8.3 Protection of Quiet Areas from Increase of Noise

The endeavours to protect quiet areas from an increase of noise are focussed on the notion of provision instead of noise remediation along existing traffic routes

General Measures

Measures to protect quiet areas demand a coordinated action of landscape, transport and urban planning. Possible measures to protect quiet areas from an increase of noise are in principle:

- Checking urban and transport planning as to their effects on quiet areas (e.g. noise generation, fragmentation of the landscape)
- Avoidance of urban extensions into quiet areas
- Creation of buffer zones within quiet areas with a differentiation of uses from the centre (quiet uses, e.g. resting areas, lawns for sunbathing) towards the outside (noisier uses, e.g. sports lawns, catering, facilities with high visitor frequency).

Measures that help to reduce the noise in quiet areas or compensate noisy measures in the neighbourhood and thus contribute to a better recreation and living quality in the town are also possible:

- In principle all noise reducing measures as recommended within the noise remediation on existing transport roads in the action plan
- Noise protecting measures along the neighbouring noise sources, for instance a green noise barrier

Quiet Areas / Continuous Open Areas

In principle it is possible to develop similar requirements for quiet areas as those that are applied for nature protection and landscape conservation. These concern the determination of the areas and the conservation and protection of individual areas or their combination. The examination of quiet areas should be made in combination with the existing planning instruments due to the fact that the goals of the Berlin land use plan and the landscape program as well as their implementation in the mandatory land use urban planning pursue the safeguarding of ecological and climatic valuable areas (which include most of the large quiet areas in Berlin).

Urban Green and Recreation Areas

The range of the possible measures especially for the urban recreation areas in Berlin is limited. Measures with relocating effects are hardly possible in an agglomeration and in the most cases don't make sense, because it is always necessary to balance the protection of quiet areas against the protection of the population from noise.

9 Consultation with the Public within Noise Reducing Planning in Berlin

Besides the intense coordination within the administration, the information and the possibility to participate of the public during the planning process happened on two levels:

- In March 2007 a “Forum Noise Reducing Planning” was invited for the first time. In this Forum the 1st working steps are described and discussed. In addition to the representatives of the Senate and the Boroughs, representatives of ADAC (Automobile Club), ADFC (Bicycle Club), the Carrying Trade Guild, the Chamber of Crafts, IHK (the Chamber of Commerce and Industry), the real estate industry, the health insurance organisations, the parties in the Berlin House of representatives and several environmental organisations participated. The objective of the noise forum was to include all socially relevant organisations, which are linked to questions of traffic noise in different aspects while planning was going on. Six presentations were made between March 2007 and October 2008.
- The strategic noise maps were presented in a press conference in September 2007. This was the start of the information of the public about Noise Action Planning. This was done in form of an internet offer by the Senate Administration for Health, Environment and Consumer Protection. This offered the possibility to play a part in the planning process with suggestions and comments.

Due to this early consultation with the public many suggestions and results from discussions were incorporated into the planning process. Parallel to this, in some surveyed areas, in which the proposals for measures had reached a certain degree of coordination, local consultations with the public were made in open councils and in addresses to the associations of businesspeople. Furthermore, coping with the desire of some boroughs, their council assemblies were informed about the state of the action planning.

The public presentation of the project was made in May 2008 in a press conference. The web presentation for the public was updated simultaneously.

Between June 2nd to July 2nd (incl.), the project of the action plan, after being published in the official journal and in three daily newspapers, was laid out for the public during one month.

The project of the action plan could be viewed in the Senate Administration for Health, Environment and Consumer Protection and in some borough offices and local quarter management offices. The public had the opportunity to participate and to comment the proposals. The deadline for the submission of statements was July 16th 2008.

Furthermore agencies, whose tasks could be affected by the noise action plan, were asked for statements, especially those agencies that had not accompanied the making of the plan, such as Common Regional Planning Bureau Berlin-Brandenburg or the Senate Administration for Finance.

9.1 Results of the Public Presentation of the Action Plan Project

After the evaluation of the statements of concerned agencies, institutions and organisations as well as 417 citizens it can be stated, that the goals and purposes of the action plan project are generally accepted. Whilst

agencies and organisations deal especially with the recommendations for measures, the private statements mostly point out the local situation experienced and demand further going measures.

The evaluation of the statements showed the following focal themes:

- The demand for further T-30 road sections in the major traffic net, especially at night
- More traffic controls by the police to reduce malpractice leading to high noise exposure, for instance, speeding and also driving with manipulated exhaust systems
- Better, less noisy traffic management, for instance, with a better coordination of traffic lights
- Noise protecting measures in the urban expressways, for instance with low noise asphalt and noise barriers
- Less noisy vehicles, especially busses and lorries
- Measures to reduce noise from railways, especially on the freight rail stretches
- Measures to reduce aircraft noise; a great part of the objections were against the extension of Schönefeld Airport

The objections show that beyond the outlined measures in the action plan, further measures to reduce noise exposure will be necessary in the future. The evaluation of the objections will be made in cooperation with the concerned agencies for each subject.

The results will be reported to the institutions and organisations in the 6th Forum for Noise Reduction Planning on October 23rd 2008 and in a meeting for the discussion of the results with the objectors on November 3rd 2008.

The objections can only be considered within limits in the noise action plan 2008, because extensive appreciations have to be made between the administration centres, the borough offices, the environmental centre of the German railways and DB-AG (the German Railways). They will be evaluated and if possible integrated into the middle and long term measures.

10 List of Abbreviations / Glossary

24. BImSchV	Directive for noise protection measures of traffic routes
34. BImSchV	Directive about noise mapping
ADAC	German Automobile Club
ADFC	German Bicycle Club
BImSchG	Federal Immission Control Act
BMVBS	German Federal Ministry of Transport, Building and Urban Development
BVG	Berlin Transport Services
dB(A)	Decibel dB referred to an A-evaluation (evaluation of frequency)
DTV	Average daily traffic volume
EG	European Community
EU	European Union
FNP	Land use plan
HotSpot	Applies in the Noise Action Planning to the noisiest areas, and /or the areas with the strongest need for action
IHK	/Chamber of Industry and Commerce
Kfz	Motor vehicle
L _{DEN}	/Day-Evening-Night noise index; noise index for general disturbance
L _{Night}	Night noise index; noise index for sleep disturbances
Lkw	lorry
LAP	Noise Action Plan
LKZ	Noise index: specific value for people affected
LSA	Traffic lights
Modal-Split	Distribution of traffic volume on different traffic modes (e.g. bicycles, passenger car traffic)
OPA	Open Pore Asphalt
ÖPNV	Public Transport
ÖV	Public transport
Pkw	Passenger car
RLS 90	Directives for noise protection on roads, Issue 1990
Schall 03	Directives for the calculation of sound immissions on railways
SOV	Southeast connection
StEP	Urban development plan, eg. StEP Traffic
T 30	Tempo 30
VBB	Public Transport Network Berlin-Brandenburg
VBUSch	Provisional calculation method for environmental noise near railways
VLB	Traffic Management Berlin

11 Materials for the Action Plan

The following measures are part of the coordinated action plan; they are suggestions and should be examined and developed further:

- Report about the exemplary road sections
- Report about the local rail traffic
- Report about the rail traffic on the DB – AG net
- Report about the Quiet Areas
- Report about the Concept Area Reinickendorfer Straße (Mitte)
- Report about the Concept road section Beusselstraße (Mitte)
- Report about the Concept Area Boxhagener Viertel (Friedrichshain-Kreuzberg)
- Report about the Concept Area Mehringdamm and about the Concept Road Section Gitschiner Straße (Friedrichshain-Kreuzberg)
- Report about the Concept Area Mierendorffinsel (Charlottenburg-Wilmersdorf)
- Report about the Concept Area Wilmersdorf and about the Concept Road Section Uhlandstraße (Charlottenburg-Wilmersdorf)
- Report about the Concept Area Wilhelmstadt (Spandau)
- Report about the Concept Area Steglitz and about the Concept Road Section Schloßstraße (Steglitz-Zehlendorf)
- Report about the Concept Area Tempelhof (Tempelhof-Schöneberg)
- Report about the Concept Road Section Potsdamer Straße (Tempelhof-Schöneberg / Mitte)
- Report about the Concept Area Neukölln/Rixdorf und about the Concept Road Section Karl-Marx-Straße (Neukölln)
- Report about the Concept Area Ober- and Niederschöneweide (Treptow-Köpenick)
- Report about the Concept Road Section Baumschulenstraße (Treptow-Köpenick)
- Report about the Concept Area Frankfurter Allee Nord and about the Concept road Section Frankfurter Allee (Lichtenberg)
- Report about the Concept Area Residenzstraße (Bezirk Reinickendorf)
- Materials about the already carried out pilot projects (Mitte, Altstadt Köpenick, Charlottenburg and Pankow)

The following materials will be available for the public participation and its results:

- The minutes of the Noise Reducing Planning forums
- A synopsis of the statements of political parties and associations
- Summarised descriptions of the objections of the citizens
- The minute of the public hearing on 11.3.2008