NMPB08 – Road Emission Model

Programmers Guide

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1. Getting started

1.1 Use a Road Traffic element

The **RoadEmissionNMPB08** uses the `RoadTraffic` structure to store the road data, and the `RoadTrafficComponent` structure to store the road vehicles data.
The `RoadTraffic` structure can refer to several `RoadTrafficComponent`, normally 2 components: one for light vehicles and one for heavy goods vehicles.

In the `RoadTrafficComponent` structure are stored the vehicle type (light vehicle or heavy goods vehicle), the traffic flow (in vehicles per hour), the mean traffic speed and the flow type (constant, acceleration, deceleration, start-up section or stopping section).

In the `RoadTraffic` structure are stored the road surface type (R1, R2, R3 …), the surface age, the ramp in percent (positive if rise, negative if down) and the vehicle components (array of `RoadTrafficComponent`).

1.2 Get the results

The **NMPB08_Lwm** function performs the Sound power level per source line meter calculation for a given Road Traffic and a given Spectrum type:

```
double* NMPB08_Lwm (RoadTraffic* roadTraffic, RoadSpectrumType spectrumType) ;
```

The “spectrumType” argument allows one to obtain the sound power in different metrics:

Value	Symbol	Values returned
0	Spectrum_dBA	The overall A-weighted sound power level
1	Spectrum_oct_A	The A-weighted sound power level in 6 octave bands ranging from 125 till 4000 Hz
2	Spectrum_3oct_A	The A-weighted sound power level in 18 third-octave bands ranging from 100 till 5000 Hz
3	Spectrum_oct_lin	The sound power level in 6 octave bands ranging from 125 till 4000 Hz, no frequency weighting
4	Spectrum_3oct_lin	The sound power level in 18 third-octave bands ranging from 100 till 5000 Hz, no frequency weighting

The programmer can also use the **NMPB08_Lwm_rolling** or **NMPB08_Lwm_traction** functions if he only wants to get the rolling or the traction component of the road emissions:

```
double* NMPB08_Lwm_rolling (RoadTraffic* roadTraffic, RoadSpectrumType spectrumType);

double* NMPB08_Lwm_traction (RoadTraffic* roadTraffic, RoadSpectrumType spectrumType);
```

Two others functions allow the programmer to calculate the rolling component or traction component of road emissions for a vehicle type:

```
double* NMPB08_Lw_rolling (   RoadVehicleType type,
                              double vehicleSpeed,
                              RoadSurfaceType surfaceType,
                              double surfaceAge,
                              RoadSpectrumType specType);
double* NMPB08_Lw_traction (  RoadVehicleType type,
                              double vehicleSpeed,
                              RoadFlowType flowType,
                              double ramp,
                              RoadSpectrumType specType);
```

2. Worked out examples

2.1 Example 1: Calculation of the Sound power level per source line meter of the road emission

In this example we calculate the sound power level per source line meter for an 8 years old road with R2 surface type and a 0.5 % slope.
The light vehicles flow is 3000 vehicles per hour, with a mean speed of 110 km/h (constant speed).

The HVG flow is 500 vehicles per hour, with a mean speed of 100 km/h (constant speed).
The code below shows how to use the **RoadEmissionNMPB08** module to calculate the A-weighted sound power level per source line meter in the 18 third-octave bands.

```
RoadTrafficComponent rtf_VL;
rtf_VL.vehicleType = VehicleType_VL;
rtf_VL.flowType = FlowType_CONST;
rtf_VL.trafficFlow = 3000;
rtf_VL.trafficSpeed = 110;

RoadTrafficComponent rtf_PL;
rtf_PL.vehicleType = VehicleType_PL;
rtf_PL.flowType = FlowType_CONST;
rtf_PL.trafficFlow = 500;
rtf_PL.trafficSpeed = 100;

RoadTraffic roadTraffic;
roadTraffic.nbComponents = 2;
roadTraffic.traffic = new
RoadTrafficComponent[roadTraffic.nbComponents];
roadTraffic.traffic[0] = rtf_VL;
roadTraffic.traffic[1] = rtf_PL;
roadTraffic.surfaceType = RoadSurface_R2;
roadTraffic.surfaceAge = 8;
roadTraffic.ramp = 0.5;

double* Lwm =  NMPB08_Lwm (&roadTraffic, Spectrum_3oct_A) ;

for (int i = 0 ; i < 18 ; i++)
{
     printf("%.2f,  ", Lwm[i]);
}
```

2.2 Example 2: Calculation of the Sound power level per source line meter of the rolling component of the road emission for heavy goods vehicles

In this example we calculate the sound power level per source line meter for an 8 years old road with R2 surface type for heavy goods vehicles.
The HVG flow mean speed is 100 km/h (constant speed).

```
double* Lw_rolling_PL = NMPB08_Lw_rolling (
          VehicleType_PL,
          100,
```

```
            RoadSurface_R2,
            8,
            Spectrum_3oct_A) ;
```

2.3 Example 3: Calculation of the Sound power level per source line meter of the traction component of the road emission for light vehicles

In this example we calculate the sound power level per source line meter for light vehicles with 50 km/h mean speed in acceleration along a down road (negative ramp).

```
double* Lw_traction_VL = NMPB08_Lw_traction (
            VehicleType_VL ,
            50,
            FlowType_ACC,
            -1.5,
            Spectrum_3oct_A) ;
```

2.4 Example 4: User-defined road surfaces

The NMPB-2008 model supports six standard road surface classes (R1, DR1, R2, DR2, R3 and DR3). As indicated in the Sétra document (part 1, § 2.7.2.4), it is allowed, under certain conditions, to used user-defined emission values for road surfaces that do not enter this classification.

In order to use a user defined road surface, an application must provide user-defined values for the rolling noise model associated with that surface. This is done by means of the following function:

```
bool NMPB08_DefineRoadSurfaceType(int idRoadSurface,
                                  double AVL, double BVL, double Vref_VL,
                                  double APL, double BPL, double Vref_PL,
                                  double const* spectrum);
```

E.g. for the example given in § 3.5.5 of the Sétra documentation, could be declared as:

```
int id_pavement = RoadSurface_UserDefined + 1 ;
double AVL = 23.7 ;     // formula (28), page 45
double BVL = 61.2 ;
double VREF_VL = 90. ;
double APL = 20.0 ;
double BPL = 68.1 ;     // road surface R3 increased by 4 dB(A)
double VREF_PL = 80. ;
NMPB08_DefineRoadSurfaceType (id_pavement,
                              AVL, BVL, VREF_VL, APL, BPL, VREF_PL) ;
```

After this call, the “id_pavement” value can be used as a surface type attached to a RoadTraffic record instead of one the predefined RoadSurfaceType symbols. E.g. :

```
roadTraffic.surfaceType = (RoadSurfaceType) id_pavement ;
```

Note that the static cast from integer value to the appropriate enumerated type is required by the C++ standard: the conversion from enumerate to integer value is implicit, but not the controversy. Most compilers, depending on options and settings, will report an error or a warning if the cast is missing.