Draft Large-scale Methodology

AM00XX: Lightweight 2-3 wheeled personal transportation infrastructure

Version 01.0

Sectoral scope(s): 07
1. **Procedural background**
   1. This draft new methodology is based on the mandate from EB89 paragraph 33(a), that agreed to initiate work in the development of a new top-down methodology for lightweight, two- or three wheeled personal transportation infrastructure, including technologies/measures for bicycles, electric bicycles and tricycles, to shift from or reduce the use of fossil fuel in transportation.

2. **Purpose**
   2. The purpose is to provide a baseline and monitoring methodology for quantifying emission reductions from project activities that involve the construction of new or expansion of the existing infrastructure for the use of bicycles, tricycles and e-bikes, such as bicycle lanes, bicycle sharing stations, bicycle parking areas, and programs to incentivize the use of e-bikes.

3. **Key issues and proposed solutions**
   3. Not applicable

4. **Impacts**
   4. The proposed new methodology will broaden the portfolio of methodological standards in the area of transportation of passengers.

5. **Subsequent work and timelines**
   5. The methodology is recommended by the Methodologies Panel (MP) and by the Small-Scale Working Group (SSC WG) for consideration by the Board at its 96th meeting. No further work is envisaged.

6. **Recommendations to the Board**
   6. The MP and the SSC WG recommend that the Board adopt this final draft methodology, to be made effective at the time of the Board’s approval.
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<td></td>
</tr>
</tbody>
</table>
1. **Introduction**

1. The following table describes the key elements of the methodology:

<table>
<thead>
<tr>
<th>Typical projects</th>
<th>Construction of new and/or expansion of existing bicycle lanes, bicycle sharing stations, bicycle parking areas; introduction of e-bikes; and/or implementation of new and/or expansion of existing passenger transportation services based on tricycles.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of GHG emissions mitigation action</td>
<td>Technology and/or fuel switching: Displacement of more GHG-intensive transportation modes</td>
</tr>
</tbody>
</table>

2. **Scope, applicability, and entry into force**

2.1. **Scope**

2. This methodology applies to project activities that shift the mode of transport of urban passengers to bicycles, tricycles and e-bikes, by implementing related infrastructure in an urban area such as bicycle lanes, bicycle sharing stations and bicycle parking areas. Implementation of new and/or expansion of existing passenger transportation service based on tricycles is also eligible. Activities to introduce e-bikes are also eligible.

2.2. **Applicability**

3. The following project activities are eligible under this methodology:

(a) Type 1: Construction of new bicycle lanes;

(b) Type 2: Extension of the existing bicycle lanes;

(c) Type 3: Implementation of new bicycle sharing stations under a new program;

(d) Type 4: Expansion of the size or number of bicycle sharing stations under an existing program;

(e) Type 5: Construction of new bicycle parking areas. These parking areas may be connected to public transport (subway stations, bus stops, light-rail train stations, etc.) or activity hubs (office towers, shopping centers, markets, venues);

(f) Type 6: Expansion of the existing bicycle parking areas;

(g) Type 7: Introduction of e-bikes;

(h) Type 8: Implementation of a new transportation service or expansion of an existing one based on tricycles;

(i) Any combination of activities described in paragraphs 3(a) to 3(h).

4. This methodology is not applicable for inter-urban transport.
5. If one or more measures described in paragraphs 3(a) to 3(h) have already been implemented within the project boundary (e.g. within the same city as the proposed project activity), it shall be ensured that there is no double counting of emission reductions while estimating the emission reductions of the project activity (e.g. by showing that infrastructure is not shared or if they are shared the relative contribution of measures is accounted for).

6. If the project involves the construction of on-road bicycle lanes, the width of any existing dedicated bus lane shall not be reduced in such a way that the traffic would be altered.

7. The applicability conditions included in the tools referred to below also apply.

8. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO₂ equivalent annually.

2.3. Entry into force

9. The date of entry into force is the date of the publication of the EB 96 meeting report on 22 September 2017.

2.4. Applicability of sectoral scopes

10. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 07 is mandatory.

3. Normative references

11. This baseline and monitoring methodology is based on the request made by the CDM-EB at its 89th meeting.

12. The methodology also refers to the latest approved version of the following methodological tools and standards:

   (a) "Demonstration of additionality of small-scale project activities";
   (b) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation";
   (c) “Baseline emissions for modal shift measures in urban passenger transport”;
   (d) “Additionality of first-of-its-kind project activities”;
   (e) “Sampling and surveys for CDM project activities and programme of activities”;
   (f) “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”.

13. For more information regarding the approved methodologies and the tools as well as their consideration by the Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) please refer to <http://cdm.unfccc.int/goto/MPappmeth>.
4. Definitions

14. The definitions contained in the Glossary of CDM terms shall apply.

15. For the purpose of this methodology the following definitions apply:

(a) **Bicycle lanes** - dedicated lanes for mobility using bicycles, e-bikes or tricycles. These lanes may be located on-road, on sidewalks or may be dedicated lanes in other areas (such as in a park, on the bank of rivers, etc.). These lanes shall be clearly identifiable, signalled and shall be durable;

(b) **Bicycle parking areas** - areas dedicated for parking bicycles, e-bikes or tricycles. The parking areas may be composed of stands or racks in open or closed areas or may be dedicated and secured rooms, and the parking service may be free or charge a fee. Parking areas may also be implemented in connection with public transportation modes (e.g. subway, rail or bus stations) or other activity hubs;

(c) **Bicycle sharing station** - sites located in urban areas where the users can check in and out bicycles. It is usually composed by docking spaces (stations with docks where bikes are parked and locked), terminals (places where users can get information about the system) and the bicycles;

(d) **E-bikes** - bicycles that can utilize an electric motor to assist propulsion by pedalling. The e-bikes should comply with any national standards or regulations for e-bikes;

(e) **Infrastructure** - under this methodology, means bicycle lanes (new or extension of existing), bicycle parking areas (new or expansion of existing areas) and bicycle sharing stations (new or expansion of the existing stations);

(f) **Tricycles** - vehicles similar to the bicycles but having three wheels. Electric tricycles that can be run on electric power to assist pedalling are also eligible under this methodology.

5. Baseline methodology

5.1. Project boundary

16. The project boundary is the area in which the user of the infrastructure and/or of the promoted bicycles, tricycles or e-bikes travels between origins and destinations.

17. If the project involves the use of e-bikes, the project boundary also includes the electric grid and all physically connected power plants that supply electricity to the grid used to recharge the battery from e-bikes.
5.2. Baseline scenario

18. The baseline scenario is assumed to be the continuation of the use of existing modes of transport in the absence of the CDM project activity.

5.3. Additionality Demonstration

5.3.1. Activities that do not generate revenues

19. The following activities, referred in paragraph 3 above, alone or in combination, are considered actions that do not generate revenues:

   (a) Type 1 and Type 2 (i.e. Construction of new bicycle lanes and extension of the existing bicycle lanes);

   (b) Type 3 and Type 4 (i.e. implementation of new or expansion of existing bicycle sharing stations), if the value paid when renting the bicycle is fully refundable upon return to the sharing station;

   (c) Type 5 and Type 6 (i.e. construction of new or expansion of existing bicycle parking areas), if no charges are applied to park the bicycles.

20. For the specific cases referred in paragraph 19, additionality is deemed automatic.

5.3.2. Other activities

21. Other activities that do not satisfy the conditions under paragraph 19 are considered additional if:
(a) The project is located in an LDC or in SIDS; or
(b) The first-of-its-kind barrier is demonstrated as per the methodological tool “Additionality of first-of-its-kind project activities”; or
(c) Activities that are type 7 (i.e. introduction of e-bikes) and the share (penetration) of e-bikes in bicycle in use in the city is below or equal to 5%;
(d) It is demonstrated, through the application of the methodological tool “Demonstration of additionality of small-scale project activities”, that at least one barrier would prevent the implementation of the project.¹

5.4. Baseline emissions

22. Baseline emissions are the emissions resulting from transportation of passengers in the absence of the project activity. It is differentiated per baseline modes of transport (relevant vehicle categories) that the project activity users would have used in the absence of the project. One of the options below shall be applied for baseline emissions.

5.4.1. Option 1: Ex-post survey of baseline travel modes

23. This option is suitable for Type 1 and Type 2 (i.e. Construction of new or extension of existing bicycle lanes), Type 5 and Type 6 (i.e. construction of new or expansion of existing bicycle parking areas) and Type 8 (i.e. new transportation service or expansion of an existing one based on tricycles).

24. Under this option, baseline emissions cover the entire emissions which would have been caused by the user of the infrastructure (bicycle lanes, bicycle sharing stations, parking areas) and/or of the e-bikes in absence of the project from origin (O) to destination (D), where the O and D points of the trip are assumed to be equal for both the baseline and the project scenarios.

25. Baseline emissions are determined by applying Steps 1 to 4 from the latest approved version of the methodological tool “Baseline emissions for modal shift measures in urban passenger transport”, using parameters estimated based on data collected during the survey in the year 1 and optionally in the year 4 of the crediting period. The survey shall be conducted with the users of the infrastructure.

26. The vehicle categories index \(i\) indicated in Step 1 of the methodological tool “Baseline emissions for modal shift measures in urban passenger transport” shall be included, and “cycling” should be considered as a potential baseline mode. If some vehicle categories are not explicitly identified or do not fit into the categories from the tool, they should be subsumed in the survey as “others” and baseline emissions of this category are counted as 0-emissions. The survey shall be undertaken at locations of the project infrastructure and origin/destination and shall be substituted for entry/exit station.

¹ When assessing the investment barrier, the investment analysis should be undertaken from the perspective of the operator/investor of the bike parking areas or bicycle sharing stations, reflecting the costs and revenues from the perspective of the operator/investor – meaning that the revenues from the parking fees and other sources (e.g. advertising) and the costs associated with the rent and maintenance of the parking area and/or the bicycle sharing station, security and personnel and the land cost and/or opportunity cost of land and/or fair value of the land shall be considered when conducting the investment analysis.
27. When applying Step 4 of the methodological tool “Baseline emissions for modal shift measures in urban passenger transport”, $P_y$ should be considered as number of trips on the new infrastructure / service per year as measured by counting possibly relying on sampling (sampling in accordance with the standard “Sampling and surveys for CDM project activities and programme of activities”). $D$ may be derived either from the survey, applied as an average value from official data or studies at the city level, or by applying the default conservative value of 2.5 km for bicycle or tricycle trips and 5 km for e-bike trips.\(^2\)

5.4.2. **Option 2: Emissions corresponding to public transportation (excluding cars, taxis and motorcycles) as benchmark**

28. This option is suitable for Type 1 and Type 2 (i.e. construction of new or extension of existing bicycle lanes) and Type 5 and Type 6 (i.e. construction of new or expansion of existing bicycle parking areas).

29. Under this option, the modal shares of the public transportation in the city (excluding travels using passenger cars, motorcycles and taxis) and the corresponding CO\(_2\) emissions are determined before the implementation of the project, using statistics from the transport authority or other credible studies. Steps 1 to 3 of the methodological tool “Baseline emissions for modal shift measures in urban passenger transport” may be applied to complement existing data, if necessary. Also, the cycling levels prior to installation of the new infrastructure ($N_{bicycles, BL}$) shall be determined ex ante.

30. The baseline emissions are calculated using the cycling levels after installation of the new infrastructure and the distance travelled by the users of the infra-structure.

$$B_y = (N_{bicycles,y} - N_{bicycles, BL}) \times ADT_{u,y} \times EF_{BL, benchmark}$$  \hspace{1cm} \text{Equation (1)}

Where:

$BE_y$ = Baseline emissions in year $y$ (tCO\(_2\)e)

$N_{bicycles,y}$ = Number of bicycles trips travelling through the bicycle infrastructure in year $y$

$N_{bicycles, BL}$ = Number of bicycle trips travelling through the location of the new bicycle infrastructure prior to implementation of the project activity.

$ADT_{u,y}$ = Average distance travelled by the users of the infrastructure in year $y$ (km).

$EF_{BL, benchmark}$ = Average CO2 emission factor per passenger-kilometer corresponding to public transportation-mix in the city (excluding travels by using passenger cars, motorcycles and taxis) (tCO\(_2\)e/pkm), before the implementation of the project, using statistics from the transport authority or credible studies.

\(^2\) According to the study “A Global High Shift Cycling Scenario”, prepared by the Institute for Transportation and Development Policy (ITDP) and by the Institute of Transportation Services (ITS) from UC Davis, a typical cycling trip distance is of 3 – 5 km and can be covered in 20 minutes using a bicycle; e-bikes can cover 10 km in 20 minutes.
5.4.3. **Option 3: Determined at the user level**

31. This option is applicable to Type 3 and Type 4 and Type 7 (i.e. introduction of e-bikes).

32. Under this option, the baseline emission factor would be determined at the individual user level. Emission reductions will be calculated by summing the product between the distance travelled by the individual users and the baseline emission factor for the individual user, based on the use of a mobile app and questionnaires. For Types 3 and 4, the bicycle sharing system manager may propose another procedure for the monitoring of the overall amount of bicycle-km travelled by the individual users.

\[
BE_{\text{user},y} = \sum_u DT_{u,y} \times EF_{BL,CO2,u}
\]

Equation (2)

Where:

- \(BE_{\text{user},y}\) = Baseline emissions in year \(y\), calculated for the individual user \(u\) (tCO2e)
- \(DT_{u,y}\) = Distance travelled by the individual user \(u\) of the infrastructure and/or the e-bikes in year \(y\) (km)
- \(EF_{BL,CO2,u}\) = CO2 emission factor per passenger-kilometer of the individual user \(u\) in the baseline (tCO2e/pkm).

33. Under this option, the parameter \(EF_{BL,CO2,u}\) is determined for each individual user of the infrastructure and/or the e-bikes by a questionnaire (for example, an online questionnaire using a mobile app or a website linked to the mobile app). This questionnaire shall be designed to determine the user’s travel mode prior to the project activity in terms of average emissions per passenger-kilometer (gCO2e/pkm).

34. The parameter \(DT_{u,y}\) shall be determined by the same mobile app used to fill the questionnaire, tracking the length of all trips accounted for by the project activity. For more details on the minimum information required, please refer to measurement procedures of the parameter in section 5.9.

35. If the questionnaire is not part of the app or website, project participants may also use the baseline emission factor determined through Option 2 above.

36. As an additional option, the baseline emission factor may be determined based on a sample of the users of the app that have answered the questionnaire. The sampling requirements from the standard “Sampling and surveys for CDM project activities and programme of activities” shall be followed.

5.5. **Project emissions**

37. Project emissions are determined based on the amount of electricity consumed to recharge the batteries of e-bikes (\(EC_{PJ,j,y}\)) using Equation (1) from the methodological tool.
“Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”.

38. The electricity consumed to recharge the batteries ($EC_{PJ,j,y}$) can be determined\(^3\):

(a) By directly measuring the electricity consumed by all bicycles included in the project (for instance in case of Type 3 and Type 4 projects); or

(b) Alternatively, assuming a default consumption of 0.015 kWh/km\(^4\) travelled. In this situation, the electricity consumed is determined according to the equation below:

\[
EC_{PJ,j,y} = 0.015 \times \sum_u DT_{u,y} \tag{3}
\]

Where:

- $EC_{PJ,j,y}$ = Quantity of electricity consumed by the project electricity consumption source $j$ in year $y$ (kWh)
- $DT_{u,y}$ = Distance travelled by the individual user $u$ of the infrastructure and/or of the promoted e-bikes in year $y$ (km)

5.6. Leakage

39. Leakage does not have to be taken into account.

5.7. Emission reductions

40. Emission reductions are calculated as follows:

\[
ER_y = BE_y - PE_y \tag{4}
\]

Where:

- $ER_y$ = Emission reductions in year $y$ (t CO2e/yr)
- $BE_y$ = Baseline emissions in year $y$ (t CO2e/yr)
- $PE_y$ = Project emissions in year $y$ (t CO2/yr)

5.8. Changes required for methodology implementation in 2\(^{nd}\) and 3\(^{rd}\) crediting periods

41. Project participants shall apply the latest approved version of the methodological tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”.

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\(^3\) Project proponents are encouraged to submit additional proposals through a request for revision of the methodology.

\(^4\) This parameter depends on a number of factors, such as terrain, level of assistance from batteries to offset pedaling set by the cyclist, weight of the cyclist, weight of the bicycle, outside temperature, direction and speed of the wind, type of battery, efficiency of the motor. Typically, a standard 36V and 10Ah e-bike consumes between 7.5 – 15 Wh/km.
5.9. Data and parameters not monitored

42. In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

Data / Parameter table 1.

<table>
<thead>
<tr>
<th>Data / parameter:</th>
<th>$EF_{BL,benchmark}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>tCO$_2$e/pkm</td>
</tr>
<tr>
<td>Description:</td>
<td>Average CO$_2$ emission factor per passenger-kilometer corresponding to public transportation-mix in the city (excluding travels using passenger cars, motorcycles and taxis)</td>
</tr>
<tr>
<td>Source of data:</td>
<td>Official statistics from the transport authority or credible studies conducted by a third party</td>
</tr>
<tr>
<td>Measurement procedures (if any):</td>
<td>-</td>
</tr>
</tbody>
</table>
| Any comment:            | Steps 1 to 3 of the methodological tool “Baseline emissions for modal shift measures in urban passenger transport” may be applied to complement existing data.  
If the data from the statistics or from the studies only allow the determination of the activity levels in terms of pkm (passenger-kilometer), a default value of 50 gCO$_2$e/pkm for buses and 0.1 kWh/pkm for metro can be used (both values based on the performance analysis benchmarks from ACM0016) |

Data / Parameter table 2.

<table>
<thead>
<tr>
<th>Data / parameter:</th>
<th>$N_{bicycles,BL}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>Number of bicycle trips</td>
</tr>
<tr>
<td>Description:</td>
<td>Number of bicycle trips travelling through the location of the new bicycle infrastructure (Type 1 or Type 2) or parked in the area of influence e.g.surroundings of new bicycle parking area the (Type 5 or Type 6) prior to implementation of the project activity in a year</td>
</tr>
<tr>
<td>Source of data:</td>
<td>Measured if required on sample basis</td>
</tr>
</tbody>
</table>
| Measurement procedures (if any): | In direct measurement method, this parameter is determined through sensors installed in the location.  
In a sampling-based method, sensors, visual counting methods or camera-based methods may also be applied. Any sampling-based methods shall be in accordance with the standard “Sampling and surveys for CDM project activities and programme of activities” |
| Any comment:            | -                                        |

Data / Parameter table 3.

<table>
<thead>
<tr>
<th>Data / parameter:</th>
<th>$EF_{BL,CO2,u}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>tCO$_2$e/pkm</td>
</tr>
<tr>
<td>Description:</td>
<td>CO$_2$ emission factor of the baseline route for the user $u$</td>
</tr>
<tr>
<td>Source of data:</td>
<td>Online questionnaire from a mobile app or from a website linked to the mobile app.</td>
</tr>
</tbody>
</table>
6. Monitoring methodology

6.1. Data and parameters monitored

43. The monitoring methodology will require the monitoring of different parameters depending on the approach selected to calculate the baseline emissions:

   (a) If the project participants decide to calculate baseline emissions based on section 5.4.1, the relevant parameters indicated in the methodological tool “Baseline emissions for modal shift measures in urban passenger transport” shall be measured for years 1 and optionally on year 4 of the crediting period. In doing so, the guidelines “Sampling and surveys for CDM project activities and programmes of activities” shall be followed;

   (b) For the other options, the monitored parameters are indicated in the tables below.

44. In addition to the parameters listed in the tables below, the provisions on data and parameters monitored in the tools referred to in this methodology apply.
Data / Parameter table 4.

<table>
<thead>
<tr>
<th>Data / Parameter:</th>
<th>$ADT_{u,y}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>Km</td>
</tr>
<tr>
<td>Description:</td>
<td>Average distance travelled by the users of the infrastructure that would not have used the bicycle in the absence of the project in year $y$</td>
</tr>
</tbody>
</table>
| Source of data:   | (a) Estimated via survey of the users of the bicycle lane; or  
                    (b) Directly measured via GPS; or  
                    (c) As a conservative approach, the average distance travelled can be assumed as 2.5 km for bicycles and 5 km for e-bikes |
| Measurement procedures (if any): | The survey shall be conducted with a representative sample of users of the bicycle lanes or bicycles parking areas, following the standard “Sampling and surveys for CDM project activities and programme of activities” |
| Monitoring frequency: | The survey shall be conducted in the year 1 and optionally in the year 4 of the crediting period |
| QA/QC procedures: | - |
| Any comment:      | - |

Data / Parameter table 5.

<table>
<thead>
<tr>
<th>Data / Parameter:</th>
<th>$N_{bicycles,y}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>Number of bicycles</td>
</tr>
<tr>
<td>Description:</td>
<td>Number of bicycles trips travelling through the bicycle infrastructure in year $y$ or parked in the bicycle parking area</td>
</tr>
<tr>
<td>Source of data:</td>
<td>Measured if necessary on sample basis</td>
</tr>
</tbody>
</table>
| Measurement procedures (if any): | In direct measurement method, this parameter is determined through sensors installed in the location.  
In a sampling-based method, sensors, visual counting methods or camera-based methods may also be applied. Any sampling-based methods shall be in accordance with the standard “Sampling and surveys for CDM project activities and programme of activities” |
| Monitoring frequency: | Measured continuously and consolidated daily if sensors are used |
| QA/QC procedures: | - |
| Any comment:      | - |

Data / Parameter table 6.

<table>
<thead>
<tr>
<th>Data / Parameter:</th>
<th>$DT_{u,y}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data unit:</td>
<td>Km</td>
</tr>
<tr>
<td>Description:</td>
<td>Distance travelled by the individual user $u$ of the infrastructure and/or of the promoted e-bikes in year $y$</td>
</tr>
</tbody>
</table>
| Source of data:   | (a) Mobile apps that record the distance travelled based on GPS; or  
                    (b) Sensors in bicycles from sharing programs |
### Measurement procedures (if any):

<table>
<thead>
<tr>
<th>Measurement procedures</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>The user of the infrastructure or e-bike shall use the app during project travel;</td>
</tr>
<tr>
<td>(b)</td>
<td>Sensors will continuously measure the distance travelled during a certain day</td>
</tr>
</tbody>
</table>

### Monitoring frequency:

If mobile apps are used or if sensors in bicycles are implemented, the parameter shall be measured while the travelling and aggregated monthly.

### QA/QC procedures:

The project proponent shall have access to the information related to the users’ travels. Data shall be controlled for outliers. For example, where the travel distances are above the higher bound of the 95% confidence level they shall be excluded.

### Any comment:

- - - - -

## Document information

<table>
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<tr>
<th>Version</th>
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To be considered by the Board at EB96. The draft version of this document (CDM-MP72-A14) was available for public input from 7 April to 5 May 2017. It received no inputs.

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