Study on the Sustainability of Low Carbon through the Recyclable Resources from the Expressways

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I. Introduction

A lot of damages from abnormal climate, following global warming, are caused across the world and opinions that such damages will become more serious in the future are predominant. Accordingly, efforts to be prepared for climate changes are being reinforced to the global level. Since the conclusion of the UN Framework Convention on Climate Change (UNFCCC) to prevent abnormal climate phenomenon, which resulted from global warming, in the Rio Summit (UN Conference on Environment and Development, UNCED) in 1992, Korea is also unrolling the eco-friendly policies to reduce carbon emissions and to pursue sustainable economic growth that necessitates efforts to reduce increasing greenhouse gases both at home and abroad.

In the case of expressways, it is recognized as a non-eco-friendly industry because a considerable quantity of carbon is emitted in the stages of construction, operation, and maintenance. Also, in the case of the discarded resources generated at the time of maintenance, new construction, extension, and route changes in the roads, several issues are raised as well because of the difficulties in proper disposal or recycling.

Accordingly, the sustainability of roads as a low-carbon and green industry, while reducing the environmental issues through the utilization of recyclable resources generated from the expressways, was contemplated in this study.

II. Scope of Research

- The recyclable resources generated from roads
- Utilization of the recyclable resources generated from expressways

III. Outcome from the Study

1. The recyclable resources generated from roads
   ○ Waste Roads
     - Waste roads mean unused land created from the process of transferring and extending expressways of which their status is as presented below.

Table 1. Waste Roads Status

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>~'12</th>
<th>~'13</th>
<th>'14~</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>15</td>
<td>5</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>20</td>
<td>2.8</td>
<td>1.2</td>
<td>16</td>
</tr>
</tbody>
</table>

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○ Waste asphalt and waste concrete
- These are recyclable resources that account for the largest part among the recyclable resources generated from the expressways.
- Generated at the time of building detours, route improvement, and road repair works.
- Recycling plan has been established under the Act on Promotion of Recycling of the Construction Wastes, but this is not properly utilized due to the difficulties in its applicability to sites.

○ Office spaces following completion of construction projects
- The site for project management group and office spaces formed temporarily for expressway construction project will become the wasted space following completion of the construction project, which will become the generated recyclable resources.

Fig. 1. The recyclable resources generated from expressways

2. Utilization of the recyclable resources generated from expressways
○ Production of the new renewable energy utilizing waste roads
  - Photovoltaic power generation by using the sites of waste roads.
    : A PV power generation facility with the capacity of 4.6 MW was installed. Operation started with five waste roads generated while transferring and extending the Jinju-Masan section of the Namhae Expressway. It was 4.6 MW in capacity that can supply electricity to 1,740 families. For this project, KRW 12 billion was spent in September 2012 to install 20,000 solar modules at 93,000 m²(approx.28,000 m²ycong) of waste roads at Jinju and Haman of Gyeonnam Province. Power generation capacity is planned to be gradually increased up to 25MW, which is the electric energy that can be used by some 9,200 families. Through this, it is expected to reduce the CO₂ emission by 14,000 ton per year.
  - A forestation of the energy bushes and generation of the new renewable energy from the sites of waste roads.
    : The optimal sites where the trees can grow fast were chosen among the unused waste road sites to establish a plan to supply the clean biofuel, which is used by the wood pellet boilers after afforesting the energy bushes by selecting the trees that can grow fast and logged, after the grown trees are cute for a certain period for logging. It is expected that this will become an idea to utilize the waste roads and revive the economy because the greenhouse gases can be reduced while creating the environmental convenience.
○ Utilization of waste concrete and asphalt concrete
  - Utilized for installing noise barrier banks and bottom of the guard rails.
  - Utilized for molding of the small structures, etc.

IV. Conclusion
In this study, the low carbon sustainability utilizing recyclable resources generated from expressways were considered. Waste resources generated from expressways have a disadvantage that their utilization method or the level