Technology Initiatives under PMGSY

1. Context

1.1 Rural roads are a key component of rural development since they provide access to economic and social infrastructure and services thereby generating increased agricultural income and productive employment opportunity in rural areas. In order to accelerate rural connectivity, the Central Government launched Pradhan Mantri Gram Sadak Yojana (PMGSY) in December, 2000. Rural roads under the PMGSY are required to be constructed to proper engineering standards and stress is laid on quality and durability of assets being created. While in the initial years of the PMGSY programme, annual investments were about Rs.2,500 crore to Rs.3,000 crore, currently the investments are of the order of Rs.20,000 crore per year.

1.2 In order to promote cost-effective and fast construction technologies in the construction of rural roads, it has become imperative to mainstream the technologies already developed through R&D in the past as also to undertake further research and technology initiatives duly taking into account the environment, geographic and other constraints. Immediate focus should be on promoting use of locally available marginal materials, industrial wastes, new materials and environment friendly cold mix technologies.

2. Mainstreaming of existing technologies

2.1 There are several technologies which are already part of IRC codes, standards and specifications or are accredited by the IRC, but are not being utilized in the field due to non-availability of standards and specifications for construction by the IRC, schedule of rates by the concerned State Governments for the new materials and/or techniques and several other factors such as difficulty in execution by contractors due to lack of awareness, non-availability of indigenous equipment, lack of information on performance of roads constructed with new technologies in India, unfounded fear of failure and the consequent accountability on the part of the engineers concerned for no fault of theirs or non-availability of suitable additives etc.

The major proven technologies considered useful for rural roads, with relevant Indian Roads Congress Codes /specifications are as under:

(i) Soil stabilization using different methods such as:
- Lime stabilization – IRC :SP- 89-2010
- Cement stabilization- IRC: 50-1973
- Bitumen stabilization – IRC :55-1974

- Mechanical stabilization – IRC : SP : 20-2002
- Innovative new additives (List of Materials accredited by IRC is available on the Website of IRC and NRRDA)

(ii) Improving properties of locally available materials and marginal materials, soft aggregates, brick aggregates etc – IRC :63- 1976

(iii) Use of fly ash in cement for concrete structures (culverts, bridges)/ use of blended cement- IRC : 112 – 2011

(iv) Roller compacted concrete pavement – IRC : SP: 68-2005

(v) Interlocking concrete block pavement – IRC : SP : 63-2004

(vi) Cold mix technology using bitumen emulsions for bituminous wearing coat (premix carpet, surface dressing) – IRC :SP : 20: 2002 and MoRD Book of Specifications.

(vii) Use of Fly ash in Road Embankment – IRC : SP : 58-2001

(viii) Use of geo-textiles, jute and coir technology in road pavements and associated works – HRB SR No. 21 - 2012 (State of the Art)

(ix) Use of waste plastic in bituminous works - Guidelines for the use of Plastic Wastes in Rural Roads Construction issued by NRRDA

(x) Use of blast furnace slag.

(xi) Use of bio-engineering measures including jute/bamboo matting for slope stabilization, crib wall, terracing with locally available pine trees, bamboos, etc. in hilly areas - HRB SR No. 21 - 2012 (State of the Art)

(xii) Use of crusher run material

(xiii) Use of quarry waste materials

(xiv) Lime Fly Ash Bound Macadam

(xv) Lime Fly Ash Concrete

(xvi) Gravel Roads (IRC:SP:77:2007) / Gravel Sealed Roads

(xvii) Cell Filled Technology

2.2 Due to the quantum jump in road development programmes in the country, availability of quality aggregates is becoming an area of concern. For construction of low volume rural roads, it is possible to use locally available marginal materials and soft aggregates by suitably modifying them with addition of lime or cement or an additive other than cement/lime and even through mechanical stabilization depending upon their strength characteristics and other chemical properties (including water absorption, etc.). The immediate focus may, therefore, be to promote and encourage mainstreaming of the above technologies so as to maximize the use of locally available marginal materials and soft aggregates. This would help not only in cost reduction but also in protecting the environment, reducing carbon footprint in the process as well as time of construction.

2.3 Many waste materials are available in different parts of the country such as construction waste, Marble dust and Slurry, Plastic waste, quarry waste materials, Blast Furnace Slag, Steel Slag, Zinc Slag, Rice Husk Ash, Paper Mill Sludge etc. Use

of such materials has already been demonstrated in various components of construction of roads. However, systematic records of their performance have not been maintained. Use of such waste materials should be encouraged for converting waste to wealth and avoiding environmental pollution.

2.4 In regions, where fly ash is available, the government guidelines already provide for utilization of fly ash in road embankments, within 100 km of the thermal power stations even when the cost of construction is higher than the traditional construction. It is a good stabilizer for black cotton soils and waterlogged areas. There are also opportunities for use of fly ash in cement concrete pavements and for concrete structures (Protection works, side drains, culverts and bridges). IRC codes provide for a minimum soil cover of 60 cm on fly-ash layer, because of which fly-ash is not being used on rural roads, on a large scale. Pond ash being granular can be used for stabilizations of soils. Pond ash can also be used as part replacement of fine aggregates in cement concrete. However, the fly-ash mission has suggested that the requirement of minimum soil cover may be reduced to 30 cm for rural roads. Fly ash can also be used for stabilization of clayey soils. Department of Science and Technology, Govt. of India (fly-ash Mission) will provide technical guidance and support for identification of area of application, testing of fly ash and training of the engineers and contractor's personnel. To facilitate the availability of fly ash and pond ash, a map showing the locations of thermal power plants is also being provided with these guidelines **Annex 1**.

2.5 Cold mix technology using cationic emulsions has also much promise, particularly in the areas of long spells of rainy season and cold climates. Several agencies are manufacturing emulsions with and without foreign collaborations. This is an environment friendly technology and is not equipment intensive. For rural roads, it would prove not only cost-effective but also enable achievement of larger lengths due to availability of longer working season particularly in north-east region and hilly states. The use of this technology may also be explored in LWE/IAP districts where there may be lack of contractors with high end equipments. Cold Mix technology will also help in better maintenance of roads. Necessary technical guidance and training can be provided by CRRI. States may also involve the material supplier in seeking technology support during application of technology ensuring quality and quantity of emulsion, by entering into technology management support agreement, which may include training of personnel of implementing agency and contractors. Cold mix technology facilitates faster black-topping of roads simply because it requires no heating and no expensive equipments. A special technical feature is the water-repellant property of cold mix technology, which may be beneficial to high rainfall regions.

2.6 Steps may also be taken to promote the use of geo-textiles such as Coir and Jute, in road pavements in areas where drainage is an issue, as well as in areas where

the soil properties can be improved with geo-textiles/geo-synthetics. As the Coir and Jute technologies have proved to be effective in protection of slopes and the State of Art Reports are available, these technologies should be used for protection of slopes and embankments. A few roads were constructed under PMGSY also, using Jute for improvement of poor sub-grade soils and the performance has been evaluated by CRRI. Similarly, some roads have also been constructed using Coir in southern States of the country under different state government schemes. The performance of such roads has been reported to be better than the controlled sections. However, specific performance reports and specifications of IRC are not yet available. National Coir Board and National Jute Board, Kolkata may provide necessary technical support and ensure the availability of materials.

2.7 In forest areas, and for providing connectivity to very small habitations, consideration may be given to construction of gravel roads, with or without thin bituminous sealing, as proposed in IRC: SP:72-2007 and IRC:SP:77-2008. Good quality gravel is available in different parts of the country. This gravel should be used as potential material for construction of low volume rural roads. A few gravel roads can also be constructed as gravel sealed roads, where sealing can be done using diluted bitumen emulsions or thin bituminous surfacing such as Surface dressing. Though no performance data on sealing of gravel roads is available in India, many other countries such as South Africa and Australia are already using such gravel sealed roads on large scale.

2.8 Measures proposed: The NRRDA may undertake the following measures for mainstreaming of the existing technologies.

2.8.1 One officer of the level of Executive Engineer, with a little aptitude and interest towards the use of such technologies, from each State be nominated as Nodal Programme Implementation Unit officer, for promoting the use of New materials/ technologies and such Nodal PIUs should be provided special training. These nodal officers will then help in identifying potential technologies for application in the field.

2.8.2 Before preparation of annual proposals, in Pre-DPR meeting with PTA/ STAs, and PIUs, States should identify list of roads with each technology considering availability of materials, viability of each technology and cost economics. DPRs of such road works should then be prepared in consultation with STAs.

2.8.3 For working out the requirements of lime/cement/mechanical stabilization of locally available materials, it is necessary to prepare a complete mapping throughout the country with details of soil classification, strength characteristics and other relevant properties on GIS platform. The availability and the quantities of materials at different quarries may be documented. Such a material characterization mapping

may be done at district level. IRC: 42 provides guidance on the tests to be conducted. Such tests can be carried out at the NITs and other engineering colleges to be identified by NRRDA/SRRDAs and anchored through the CRRI. The CRRI has been requested to formulate a proposal for this mapping of materials on an urgent basis for being financed as a research project by the NRRDA. For steering the progress in this effort, a core P&I Group may be constituted by the NRRDA. As the work of mapping of materials is voluminous, IITs, NITs, PTAs, STAs and other engineering institutions of the country may also be involved in achieving this task by providing financial support for research projects to such institutions. State governments may be requested to provide basic information about the material quarries. Some basic data is available from Rajasthan from an old R-1 Study funded by Ministry of Road Transport and Highways. These reports of R-1 study may be used as a basic guide for mapping of materials.

2.8.4 While exercise indicated in para 2.8.3 may continue, it is also necessary to simultaneously proceed with incorporating the use of such materials in the project estimates of every state. It is proposed that in the first year, a target of minimum 15 (fifteen) percent length of the annual proposals from each State should be taken up under this, and this should be made mandatory. For this, PTAs/STAs concerned need to be mandated to identify locations of the local materials for the project stretches and evaluate their strength characteristics. The project stretches could preferably be in a few specific blocks/districts so as to include a much larger proportion of overall length in these blocks/districts. Thereafter, the cost-effective stabilization technique and the specifications and design to be adopted should be proposed by the PIU under guidance of STA/ Technology Provider or other technical expert and vetted by the PTA/CRRI. The Detailed Project Reports (DPRs) for road works with any such technology initiative should be prepared with due diligence after studying the properties of materials to be used and the requirements of technology. States may consider separately empanelling more experienced and well equipped consultants for preparation of DPRs for such works. The regional reviews being carried out by the NRRDA may include progress on this front also as one of the key performance indicators of SRRDAs. The goal should be that in due course these technologies become a common practice in construction of rural roads all across the country. As the IRC specifications for most of these technologies are already available, States may enter into MoU with STAs or any other recognized government agency for performance monitoring of such roads, at local level and the expenditure on this may be met from administrative expenditure fund. The State and STAs may decide mutually the fees for performance monitoring at the time of entering into bilateral MoU.

2.8.5 The NRRDA has separately entrusted the task of revising the specifications for Rural Roads and Standard Data Book for analysis of rates to IRC All the technologies indicated in para 2.1 above should be covered in the review of these

documents. The Standard Data Book could then be utilized by the PTAs/STAs in supporting the PIUs in preparing analysis of rates and incorporation of the BOQ items in the project estimates.

2.8.6 Special care would be required by the PIUs / Consultants in preparation of DPRs and by STAs/ PTAs in scrutiny of DPRs using such materials/technologies. The materials proposed to be used need to be tested to suit the requirements of the project. Also the traffic survey for such roads is to be carried out with greater reliability and design traffic to be projected. The State governments should also ensure that the traffic plying on such roads after construction is not higher than the design traffic, so as to avoid chances of failure of such technology demonstration projects which may otherwise lead to poor performance of the material/technology.

In all such cases the DPR of New Materials / technology will be prepared after site inspection jointly by the DPR consultant, officer of Programme Implementation Unit and the State Technical Agency and after a discussion regarding choice and suitability of New Material/ Technology.

2.8.7 Special care would be required by the contractors for execution of works with such materials/technologies. It will be necessary to incorporate such requirements in the Standard/Model Bidding Documents. The PTAs/STAs would also be required to support the PIUs initially in supervision of the works being executed with such technologies and ensuring quality control. This, in itself, will require capacity building of the STAs besides that of the PIUs. It will be more appropriate to identify the technologies suitable for different areas and provide focused training including field demonstrations to the engineers working in PIUs and STAs of those areas for application of specific technologies. The CRRI and other institutes of academic excellence can be entrusted with the task of capacity building of the PIUs and STAs. In fact, under the sponsorship of NRRDA, the CRRI can be a key partner to provide overall technical support in mainstreaming of the current technologies in execution of PMGSY. Needless to mention that the CRRI would need to associate a few external domain experts including PTAs/ selected STAs in this exercise.

2.8.8 Necessary modifications should be made in the Bidding documents to incorporate the following provisions:

(i) For the technology-driven component of the work, only those firms who possess the requisite competence shall be allowed to offer the bids.

(ii) The selected bidder i.e. the Contractor who is awarded such work component shall not be allowed to sub-contract the work.

(iii) Additional comfort shall be provided to the Contractor by way of guidance on the quality control requirements during execution by the PIU concerned with support of the STA.

(iv) For such works, stage passing shall be mandatory, i.e. quality control checks are undertaken before next layer is allowed to be laid.

(v) For such technology-driven component of work, the Defects Liability Period shall be only six months after issue of Take Over Certificate. Thereafter, neither the Employer nor the Contractor will be held responsible. The supervision engineer / project implementation unit and the STA concerned would also not be held responsible for any defect appearing after the said period.

2.8.9 For execution of works utilizing these technologies, it would be necessary to go in for appropriate and special equipments, particularly for stabilization. It is suggested that a separate Group comprising some domain specialists and representatives of a few equipment manufacturers may deliberate over the requirements for such specialized equipments and identify the steps needed to facilitate execution of works by the contractors. Low end locally developed equipments may be more useful and viable and to promote use of such available equipments and development of new equipments required for new technologies, a separate group should be set up in IRC. The TOR for such a group may also include consideration for providing opportunities for low cost, light and portable equipments in construction of rural roads without compromise on quality. This will provide the much-needed support to small local contractors who may hesitate or are otherwise not in a financial position to invest heavily in purchase of equipments. Already available low end equipments needs to be demonstrated in other areas and efforts should be made to allow their use by developing specifications of equipments. Equipment banks may be created at State / regional levels, so that local contractors can hire these equipments for execution of works entrusted to them.

2.8.10 The procurement procedures for execution of works would also need review to identify any additional requirements of special equipments and specialized technical personnel. Since these technologies are not in normal practice with the contractors, it would be necessary to make arrangements for training their personnel (site engineers, construction workers and equipment operators). For this, dialogue with the contractors may be arranged in different regions of the country. For some of these technologies, for instance cold mix technology, emulsion is to be supplied by different manufacturers for which specific instructions of these manufacturers for their use would need to be adhered to. Initially, the support of these manufacturers may be required to alert the PIUs and STAs and to provide technology management support including training.

2.8.11 During execution of works, it will be advisable to undertake documentation of procedures observed, quality control tests conducted and operation of equipments, etc. through videography of various activities so as to help in dissemination at other sites and to serve as training material.

2.8.12 In case of some materials and technologies, the initial cost of construction may be higher than the cost of construction using traditional materials, though the new technology may prove to be more durable and may require lower maintenance. Accordingly, Life Cycle Cost analysis including social and environmental costs should always be carried out and documented in the DPR.

2.8.13 Information about the new technology and associated benefits of new technology such as lower maintenance requirement or durability should also be shared with local community with complete transparency so as to avoid any resistance from community.

2.8.14 Capacity building of second and third tier quality management systems i.e. SQMs and NQMS will be mandatory to support the execution of such technology demonstration works ensuring quality. For this, round table conferences of NQMs and SQMs with CRRI/PTAs/Technology providers should be organized for sharing of information.

2.8.15 Most of the States are not coming forward in taking up proposals with new materials /technologies perhaps due to the fact that contractors are quoting higher rates for such works and the tender premium is to be borne by the State. MoRD may consider allowing such higher rates from savings of various phases of PMGSY scheme.

3. Promoting use of innovative materials and technologies

3.1 In order to encourage innovation in development of materials and construction technologies, the IRC have adopted the practice of accreditation of materials and technologies. List of such accredited materials and technologies is available on websites of both IRC and NRRDA **(Annex 2)**. These include enzymes and chemicals. A list of materials/ technologies already used / project sanctioned on pilot basis under PMGSY till December, 2012 is enclosed **(Annex 3)**. These accredited materials may be divided into two groups. One group will be where trials have been completed and results are found to be satisfactory. For such materials and technologies as also relevant for rural roads, it would be advisable that performance of such demonstration projects are evaluated, analyzed and specifications developed, before these materials can be recommended for use on large scale. A report on performance of such materials/technology should be obtained from the

road agency under whose jurisdiction the demonstration project has been carried out. The work of performance analysis of demonstration projects can be carried out through research institutions like CRRI/PTAs/IITs/NITs/State Engineering Research Institutions and other well established engineering institutions. These institutions will also play an important role of creating awareness among the field engineers through trainings/ workshops and helping in the dissemination of technology. As the development of IRC specification may take some more time, Ministry of Rural Development / NRRDA may consider issuing the following guidelines for use of such materials as have been accredited by the IRC.

3.1.1 For the first year, a target of minimum **five** percent length of the annual proposals from each state with new materials / techniques may be considered by the NRRDA. This can be gradually increased as more experience is gained in handling these materials/technologies.

3.1.2 For such materials/technologies, it is necessary to obtain warranty of performance and stability in price regime for the product from the technology provider/industry even though performance analysis from elsewhere has shown satisfactory results. An MoU may be signed between NRRDA, SRRDA and the material /technology provider for this purpose. Performance reporting for a period of two years should be made mandatory in all such cases. A draft MoU, is placed as **Annex 4**. The provision of fee to the tune of 2.5 percent of project cost for preparation of DPRs and performance monitoring by Material Supplier/ Technology Provider through a Technical Expert, as proposed in the draft MoU, will be applicable with prior approval of MoRD / NRRDA in first few cases in each State and will be released by MoRD.

3.1.3 With the help of technology provider/industry, the STA concerned, where demonstration has proved successful, should prepare the draft of specification and methodology of construction. This should, thereafter, be got vetted by the NRRDA from the PTA/CRRI. On satisfactory performance of technology in a few cases, NRRDA will take up the matter with IRC for preparation of Codes/Specifications for the technology.

3.1.4 The PTA/STA may guide the PIU in preparation of analysis of rates based on the processes involved in execution of these items and considering identical items already available in Standard Data Book of MoRD, so that it becomes a standard BOQ item for incorporation into the project estimates. Rates of such items then may also be vetted by senior officers of SRRDA. R & D cell of NRRDA will also help the States in this exercise.

3.1.5 Measures proposed in para 2.8 would apply to such materials/technologies also.

3.2 The second group covers such materials and technologies as have been accredited by IRC but have not undergone any field trials or even if they are not so far accredited by the IRC but are industry backed and found or claimed to be in use in other countries with similar geographic/climatic situations and considered promising from the point of view of enhancing performance and durability and cost-effectiveness. The technology provider should feel free to file an application with the NRRDA expressing his interest in demonstration of his product in the field. Such application should accompany the value for money analysis of the product/technology. For such materials/technologies, the NRRDA may consider their use first as demonstration projects with suitable safeguards/warranties from the industry. It is in the nation's interest to take up such demonstration projects on a fast track basis. A suitable fund could be set apart from the PMGSY budget for such demonstration projects. Locations and sample size of demonstration projects should be decided by the NRRDA in consultation with the SRRDAs. It may be advisable to undertake trials at least at five locations spread across different states. This will help capture the repeatability of the technology in the milieu of different road agencies, state technical agencies and contractors. The materials and technologies which are not accredited by IRC but are backed by the industry should be reviewed by three-member group of Experts appointed by the NRRDA. This group will examine the merit and appropriateness of the material or technology proposed to be piloted.

3.3 For such demonstration projects, the industry has to act as a strong partner of NRRDA as an enabler of technology development. It should, therefore, provide technical backstopping to the concerned PIU and STA. Since there could be risk of failure of such technologies, some mechanism needs to be evolved for protection of the personnel belonging to PIUs and STAs and even contractors for their bonafide actions. The government would need to adopt a liberal approach during the trial stage, of course with pre-specified checks and balances. This would also help in reducing/eliminating their resistance to take up such demonstration projects on ground. However, the quality control checks as per PMGSY guidelines, should be rigidly adhered to. In case of technology demonstration projects, Stage passing should be made mandatory i.e either STA or SQM should visit the site and carry out quality checks before next layer is laid. This will avoid chances of failure due to improper quality control or application of technology. The type of tests and their frequency needs to be specified by the technology provider at the time of preparation of DPR. The NRRDA may undertake a comprehensive dialogue with some of these industry entrepreneurs to identify the role and responsibility of each of the stakeholders (PIUs/STAs/PTAs/industry, contractor) in such demonstration projects. **Box 1** gives an indicative matrix of roles of various stakeholders.

3.4 For the projects to be taken as demonstration projects, specific arrangements should be identified in advance for any instrumentation needs and evaluation of

performance. For such projects, performance should be monitored on regular basis for a period of at least two years after opening of road to traffic. Advantage should also be taken of the APTF available with the CRRI for getting quick results. The NRRDA may consider awarding research projects to CRRI to study the performance of alternate materials/ new materials/techniques through the use of APTF. NRRDA may develop a standard performance evaluation methodology with support of industry and PTA/CRRI. While developing the standard methodology, there is need to factor in situations where the methodology of performance evaluation could vary somewhat depending upon the innovative material/technology being piloted. A typical format for performance evaluation is placed at **Annex V**

3.5 Another strategy that must be considered by the NRRDA for such demonstration projects is to create a control section with conventional materials side by side. This will help in assessment of the cost-effectiveness of the technology being demonstrated. The control section should have the thickness and materials as per IRC standards for rural roads. For all the technology demonstration projects, the control section may be of about 25 percent road length and 75 percent road length should be with IRC accredited technologies. STAs/PTAs should be adequately compensated for taking up the work of performance monitoring. However, for taking up demonstration projects with technologies not accredited by IRC, only short stretches of 0.5 km may be adequate, and in all such cases, performance reporting by STAs/PTAs/ Technical Consultants should be made mandatory.

Box 1: Technology Demonstration Projects
(Roles and Responsibility Matrix)

A. NRRDA

(i) Bear full cost of construction of the trial section.

(ii) Consider and recommend, the locations identified by SRRDAs for demonstration of technology in consultation with the SRRDA/STAs/PTAs/Technology Providers.

(iii) Obtain and negotiate warranty from the industry/technology provider.

B. Industry/Technology Provider

(i) Provide value for money analysis of the product and warranty of performance to the NRRDA.

(ii) Technical backstopping of PIU and STA/PTA.

(iii) Training to be imparted to site engineers, equipment operators and construction workers of the contractors. Also provide stipend to workers and equipment operators for the period they are off site during training.

(iv) Support the STAs in supervision of the work being executed by the contractors.

(v) Assist the SRRDA in installation of performance monitoring instruments/equipments required, if any, at the time of execution of the work.

(vi) Join the STA and PIU in periodic monitoring of performance, say every six months, after the road is open to traffic. Performance would be monitored for a period of two years.

C. SRRDA and PIU

(i) Assist the NRRDA in finalizing the location of the demonstration project.

(ii) Enter into agreement with the Technology Provider/ Material Supplier/ STA in preparation of project estimate, supervision during execution and periodic monitoring of performance for a period of two years after the road is open to traffic.

(iii) Oversight on the performance of the STA and the contractors.

(iv) Ensure installation of performance monitoring instruments during execution of demonstration projects.

(v) Join the team of technology provider and STA in periodic monitoring of performance.

(vi) Ensure that such roads are properly designed for the traffic expected on them. During performance evaluation period, care is to be exercised to further ensure that the traffic on such roads is controlled to the level of design traffic.

D. STA/PTA

(i) Enter into agreement with the SRRDA as a turnkey partner in technology development process including preparation of project estimate, supervision and quality control during construction, and post-construction periodic monitoring of performance for a period of two years.

(ii) Expose its personnel to training by the industry/technology provider.

(iii) Support the industry/technology provider in training of contractors' personnel (site engineers, equipment operators and construction workers).

(iv) Documentation of the procedures observed, methodology of construction, quality control tests conducted, operation of equipment and post-construction performance monitoring.

(v) Preparation of handouts/booklets for wider use of the technology and dissemination.

(vi) Development of specifications for the technology on successful trials for inclusion in book of specifications by IRC.

3.6 Once the demonstration projects prove successful, the technologies and materials tested under such projects should be dealt with as per the strategy proposed in paras 3.1 and 2.8.

3.7 NRRDA may insist with IRC to review their procedure for such technologies to be mainstreamed. For this, the specifications should be finalized on a fast track and time-bound basis. In the meantime, NRRDA may develop its own codal

provisions or consider issuing guidelines based on recommendations of Standing Advisory Committee of NRRDA, for utilizing these technologies in the construction of rural roads in the country.

4. Technology Development

4.1 The Highway Research Board of the IRC undertook an exercise sometime back to identify major thrust areas in the highway sector covering road pavements, bridges, geotechnical engineering, traffic engineering and safety related schemes. Huge investments are being made for rural roads under the PMGSY and other state level programmes and schemes. Some of the thrust areas considered useful and relevant for rural roads are as under:

(i) Evolving low cost cross drainage structure designs.

(ii) Evolving bio-engineering measures for improving slope stability in hilly areas.

(iii) Promoting recycling of pavements for up-gradation/rehabilitation projects – evolving guidelines and warrants for recycling.

(iv) Evolving simple models for Asset Management System of rural roads.

(v) Evolving pavement performance prediction models for determining rate of deterioration of pavements with time, traffic and weather.

(vi) Evolving simple methods/ technologies for maintenance of rural roads.

(vii) Evolving low cost erosion control and drainage measures.

(viii) Bridge construction technologies to achieve faster construction – pre-casting technologies, steel superstructures. Also evolve standard designs for bridges on rural roads.

(ix) Pre-cast technologies for small CD structures (culverts), and similarly pre-cast side drain system.

(x) Scope for composite construction technology in rural roads.

4.2 There are quite a number of academic institutions and research agencies in the country who can be approached in this effort. It is suggested that MoRD/NRRDA may earmark at least **one percent of the annual budget for such R&D work** so that such schemes as are of immediate relevance for the sector can be taken up on a regular basis. Such institutions should also come forward for developing and evolving technologies suitable for the region considering the local requirements.

4.3 For giving push to such research, a core P&I group of two-three experts can be constituted from within the standing Advisory Committee of the NRRDA. This Core group will provide technical support to NRRDA in recommending such research proposals for the benefit of rural road sector.

5. Preparation of Manuals/Handouts and Dissemination

5.1 It is suggested that the proposal for CRRI to serve as key partner for NRRDA in this entire effort, may be entrusted with the task of preparation of Manuals and Handouts on the current technologies and accredited materials that have proved to be successful. The CRRI could be asked to associate external experts including PTAs where considered necessary. Manuals may also incorporate sections on Do's and Don'ts to alert the PIUs and contractors.

5.2 The draft of these Manuals and Handouts should be discussed at regional workshops with PIUs and STAs. Based on feedback, the drafts can then be finalized and printed. These documents can also be hosted on the PMGSY website for wider dissemination. The gist of these handouts can also be published in IRC journals and NRRDA news letter – Grameen Sampark.

5.3 These documents would be useful for dissemination of the technologies among the various stakeholders – road agencies, contractors, consultants, state technical agencies, etc. For this, regular half-a-day workshop could be held at the time of regional reviews of PMGSY programmes by the NRRDA and SRRDAs. STAs/PIUS involved in technology demonstration projects should present the details of such projects with the help of photographs /videos for dissemination of technology.

5.4 Technical films on such technology demonstration projects, covering various steps involved in selection of site, technology selection, material testing, design, DPR preparation, various aspects of construction, life cycle cost analysis, advantages of technology etc. should be prepared in sample cases for effective demonstration of new technology. Such films of high quality and resolution can then be used by training institutions for training of officers/ contractors personnel. These films should also be made available on websites of NRRDA/ SRRDAs.

6. Training and Awareness

6.1 As discussed earlier, it is absolutely necessary to build the capacity of various stakeholders in mainstreaming of the existing technologies which are not currently being practiced, and for promoting new materials and technologies being developed by the industry.

6.2 The CRRI may be the nodal agency for this purpose, and the other existing training centres should also be utilized, such as IAHE, NIRD, NAC, IITs, other academic institutions including the PTAs/STAs in this task.

6.3 A directory of guest faculty may also be prepared by the CRRI for enlisting outside support in preparation and delivery of training material for such technologies.

6.4 Visits of PIUs/SRRDAs/PTAs/STAs should be arranged to good practice projects both within India and outside, to create awareness and raising their benchmark. A record of such site visits to the demonstration projects should be maintained on PMGSY website, along with the details of technology used.

6.5 Some of the new technologies have already been tried on pilot basis in PMGSY also in some States. The details of such roads should be made available on the Website of PMGSY, so that officers from different States with identical conditions for utilization of technologies can interact and can seek help from such PIUs. NRRDA may help in providing video films showing all steps of design, testing of materials, tendering, execution and performance of different technologies, on their website.

6.6 NRRDA may also seek the support of contractor's organizations to arrange regular colloquium with them in various regions of the country, for demonstration of such technologies involving STAs / PTAs/ SRRDAs. Technology providers may also be involved in providing such training and field demonstrations.

7. Awards

7.1 A system of awards may be instituted to recognize the contribution of:

- NRRDA
- SRRDAs
- PIUs
- PTAs/STAs
- Technology Providers
- Contractors
- Technical Experts

in mainstreaming and up-scaling the innovative technologies in construction and maintenance of rural roads. It is suggested that One award for each of the above categories except the PIUs, for whom minimum five awards annually may be recommended to encourage the large scale utilization of such technologies. Such awards may be given in annual meetings of MoRD on recommendation of jury to be set up by the NRRDA

7.2. MoRD / NRRDA may also consider providing sponsorship to the officers of States/ CRRI/PTAs/STAs for publication of research papers in National / International events for encouraging research and recognizing their contributions in such effort.

References:

1. IRC :SP- 89-2010 – Guidelines for Soil and Granular Material Stabilization using Cement Lime and Fly Ash.
2. IRC: 50-1973 – Recommended Design Criteria for the Use of Cement Modified Soil in Road Construction.
3. IRC :55-1974 – Recommended Practice for Sand-Bitumen Base Courses.
4. IRC : SP : 20-2002 – Rural Roads Manual
5. IRC :63- 1976 – Tentative Guidelines for the Use of Low Grade Aggregates and Soil Aggregates Mixtures in Road Pavement Construction.
6. IRC : 112 – 2011 – Code of Practice for Concrete Road Bridges
7. IRC : SP: 68-2005 – Guidelines for Construction of Roller Compacted Concrete Pavements.
8. IRC : SP : 63-2004 – Guidelines for Use of Interlocking Concrete Block Pavement
9. IRC : SP : 58-2001 – Guidelines for Use of Fly Ash in Road Embankments
10. HRB SR No. 21 - 2012 (State of the Art) - Use of Geo Textiles in Road Construction and Prevention of Soil Erosion/ Landslides.