MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
National Aviation University

STRENGTHENING OF REINFORCED CONCRETE AND STONE MEMBERS IN DAMAGED AND RECONSTRUCTED BUILDINGS AND STRUCTURES

Visual Aids Manual

Kyiv 2016

УДК 692:693.5 (075.8)
ББК Н530я7
S 88

Authors: A. Y. Barashikov, O. I. Lapenko, V. M. Pershakov, A. O. Belyatynsky, P. S. Bilokurov

Reviewers: *O. I. Golodnov* – Doctor of Technical Sciences, Professor (LLC "Ukrainian Institute of metal constructions name of V. M. Shymanowskogo");
M. S. Barabash – Candidate of Technical Sciences, Associate Professor (LLC "LIRA-SAPR");
A. M. Akmaldinova – Candidate of Philosophical Sciences, Professor (National aviation university)

Approved by the Methodical and Editorial Board of the National Aviation University (Minutes № 1/15 of 12.03.2015).

Наочний посібник являє собою перелік схем та креслень з підсилення залізобетонних та кам'яних конструкцій будівель та споруд, а також основ та фундаментів. У ньому розглянуто технічні вирішення з підсилення плит, балок колон, стін та перегородок, основ та фундаментів (понад 500 варіантів), що використовуються під час ремонтних робіт та реконструкції. Також подано вирішення щодо реконструкції та відновлення окремих частин елементів будівель. Усі креслення супроводжуються поясненнями.

Для студентів напряму підготовки 6.060101 «Будівництво», а також інженерів-проектувальників, будівельників та фахівців з експлуатації будівель та споруд.

Strengthening of reinforced concrete and stone members in damaged and reconstructed buildings : Visual Aids Manual / A. Y. Barashikov, O. I. Lapenko, V. M. Pershakov and others. – K. : NAU, 2016. – 128 c.

S 88

ISBN 978-966-598-970-7

The Manual is set of schemes and drawings on strengthening reinforced concrete and stone members and structures as well as on stabilizing foundation bed soil. It presents a summery of technical solutions on strengthening slabs, beams, columns, walls, partitions, beds and foundations (over 500 variants), which have founf a wide application in repair and reconstruction building works. Details of reconstruction and rehabitation of separate parts and elements of buildings are considered as well. Drawings are accomponied by explanatory notes.

The Manual is intended for students of Bilding inatitutes as well as for design, building and exploitation engineering workers.

ISBN 978-966-598-970-7

УДК 692:693.5 (075.8)
ББК Н530я7

INTRODUCTION

This manual covers a wide range of questions, that relate to strengthening and repairing of bearing structures of the building, from the foundation and finishing the roof.

The given atlas deals with solution of practical problems arising in case of damaged or collapsed buildings repair as well as in case of buildings reconstruction. The authors of the book followed the aim to show graphically, in accessible form different ways of strengthening building members and of stabilizing bed soils.

This manual is for illustration only and gives specialists the opportunity to choose the most suitable and effective of those ways with the account of the least possible losses in material and labour force resources.

It is a kind of an atlas of schemes and drawings which instead of giving detailed theoretical conclusions, calculation and design methods presents a guide to practical measures. Here one can find different ways of strengthening of reinforced concrete roof members (slabs, beams, trusses), columns, multy-storeyed frames, bearing units and connection joints. Also recommended are methods of floor slab opening formation and those of restoration of missed cast-in items a*s* well as ways of strengthening brick walls, posts, partitions, of patching cracks and restoring damaged sections in brick wall facing. Consideration is also given to such problems as laying the foundations close to existing buildings, protection of underground structures against wetting, reconstruction and restoration of separate parts and elements of buildings.

A. Y. Barashikov (KNUBA)
O.I. Lapenko, V.M. Pershakov , A. O. Belyatynsky (NAU)
P.S. Bilokurov, K.M. Lysnytska (NAU)

ATLAS INDEX

4 PAGE

Table 1. *STRENGTHENING OF BUILDING MEMBERS, THEIR CONNECTION JOINTS AND FOUNDATIONS OF BUILDINGS AND STRUCTURES*

Strengthened members, units and foundation beds	*Ways of strengthening*	*Page*	*References*
Destruction of concrete reinforced concrete and stone members	Use of explosion, water jet, electrio discharge, oxygen lances; mechanical method	9	11, 140
Strip foundations	Arrangement of concrete lugs, reinforoed concrete yokes and pads; positioning of relieving beams; reconstruction of foundations into slab ones; stabilisation of foundation masonry	10-18	7, 14, 25, 30, 37, 38, 48, 69, 70, 75, 113, 120, 124, 132, 137, 141, 146, 147, 171, 172, 175, 176
Pad foundations	Arrangement of reinforced concrete jackets; outrigging of columns; transfer of load to foundation bed; reconstruction of foundations into strip ones.	19-24	3, 4, 14, 37, 48, 58, 68, 70, 103, 113, 132, 141, 146, 147, 170
Foundations strengthened by transfer of load to piles	Transfer of partial load to driven cast-in-plaoe, metal bore injected piles, solid and composite; use of other struotural elements for foundation strengthening	25-28	1, 2, 35, 50, 70, 104, 143, 146, 147, 167, 170
Slab foundations	Arrangement of yokes; reinforced conorete splicing; positioning of relieving beams	29	50, 70, 103, 132, 141, 142, 147
Strip grillages	Splioing of grillages from above, below and from sides; rrangement of reinforced concrete jackets	30	70, 94, 103, 141, 142, 147
Pile-to-grillage connection joints	Arrangement of reinforced concrete and metal yokes and jackets; positioning of metal props, etc.	31	70, 103, 141, 142, 147

Table 1. *(continued)*

Strengthened members, units and foundation beds	*Ways of strengthening*	*Page*	*References*
Foundations laid close to existing building	Arrangement of enclosing sheeting, cantilever protruding bars, driven and bored piles	32-34	1, 35, 36, 50, 65, 70, 91, 95, 105, 114, 117, 126, 147, 152
Shoring of trench and pit walls in carrying out construction work near the existing building	Erection of retaining walls; use of different shoring systems for trenoh and pit vertical walls	35-37	11, 50, 59, 149, 151, 154
Pile driving near the functioning buildings	Choice of safe distance from the pile to be driven to the functioning buildings	38	50, 105
Retaining walls	Splicing; setting of stays, buttresses, relieving blocks and slabs	39-40	80, 70, 103, 141
Foundation beds	Stabilization of soils by solution injection; thermal stabilization; use of hydrojet technology, etc.	41-43	3, 4, 14, 41, 48, 49, 54, 56, 59, 61, 65, 70, 89, 90, 125, 134, 143, 146, 147, 150
Columns	Arrangenent of cast-in place and precast yokes; setting of struts, substruts, relieving elements	44-46	8, 19, 24, 42, 70, 78, 85, 103, 141, 142
Columns cantilevers	Setting of tension bars, channel props, yokes - stirrups, welded plates	47	70, 86, 103, 141, 142
Column-to-foundation connection joints	Arrengement of reinforced concrete and metal yokes; splicing of foundation column housing walls	48	

Table 1. *(continued)*

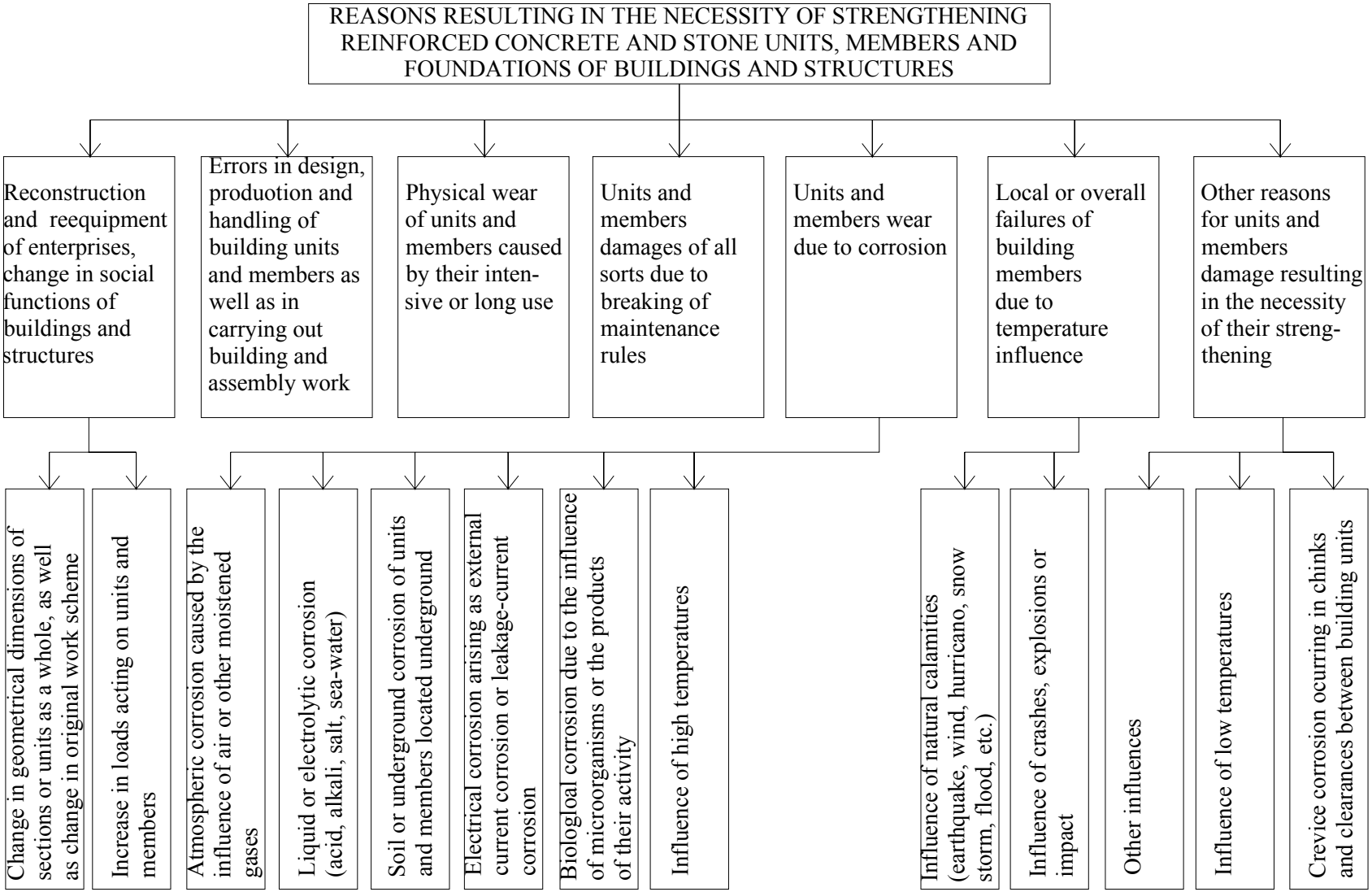
Strengthened members, units and foundation beds	*Ways of strengthening*	*Page*	*References*
Gireder-to-column connected joints	Setting of stirrups, additional rods, plates	49	70, 84
Wall-to-column connected joints	Setting of stirrups, supporting props, plates	50	70, 84
Floor panel-to-wall connection joints	Positioning of additional supports; concreting; setting of tension bars	51	74
Multy-storied frames	Setting of half pier, substruts, posts, frames, braces, tension bars	52	70, 103, 141, 142
Crane girders	Attaching of beams to columns; strengthening of damaged supports; fastening of crane rails	53	70- 84
Concrete wall panels	Setting of metal cover plates; glueing of metal strips and reinforcement; concreting; positioning of relieving columns	54	17, 26, 70, 74, 102, 108
Brick walls	Arrangement of metal chords, pads, reinforced concrete chords; setting of reinforcement	55-61	1, 6, 27 ,37, 46, 57, 50, 70, 75, 90, 107, 109, 110, 111, 112, 122, 123, 124, 140, 141, 145, 178, 179
Brick wall connection joints	Conneotion by tension bars, braces, metal cover plates	62	58,75,107
Beam and slab bearing units on brick walls	Arrangement of metal and reinforced concretc yokes; positioning of relieving posts, walls, beams	63	12, 70, 75
Brick lintels	Setting of cover plates, tension bars; positioning of beams	64	16, 50, 60, 70, 107
Brick wall facings	Setting of steel braces; facing replacement; plastering	65	29, 33, 50, 70, 71, 102, 107
Brick posts and piers	Arrangement of metal, reinforced concrete, brick and mortar yokes, jackets; positioning of posts; setting of reinforced concrete and metal cores	66- 69	16, 29, 46, 51, 58, 67, 73, 75, 107, 123, 124, 128, 138, 139
Elimination of defects on large panel wall surfaces	Pointing up and filling with putty of cracks, bugholes and scalings	70	74, 76
Patching of cracks in brick walls	Setting of metal dowels; insertion of brick keys; injection of cement-sand mortar	71	58, 66, 88, 107, 108, 115
Formation of openings in brick walls	Positioning of lintels, channel and angle frames over the openings formed	72	67, 68, 69, 70
Protection of brick walls against wetting	Arrangement of air slots, clay locks, drainages	73	6, 16, 23, 43, 46, 58, 98
Restoration of brick wall horizontal waterproofing	Arrangement of hydraulic seal roll; injection of siliconorganic compound solutions; protector method; galvanoosmose method	74	13, 16, 38, 43, 58, 66, 82
Restoration of concrete cover	Plastering by mortar; guniting; conoreting; polymer concrete coating	75	5, 55, 80, 86, 97, 99, 108, 119, 130 40,46,55,86,99
Patching of cracks in concrete and reinforced concrete members	Injecting of tamping grout with magnetic properties, of cement-sand mortar; filling with synthetic putty	76	

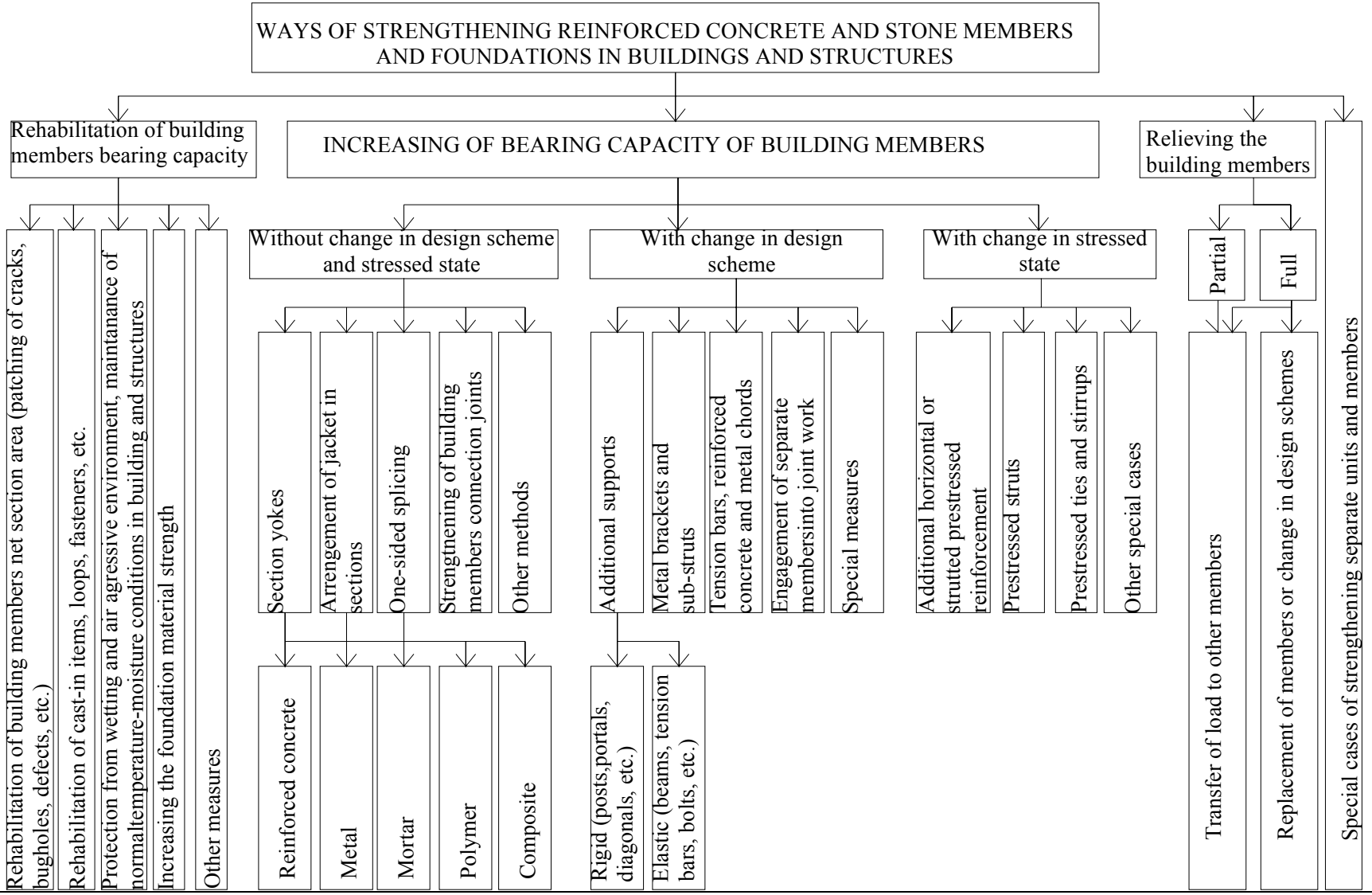
Table 1. *(continued)*

Strengthened members, units and foundation beds	*Ways of strengthening*	*Page*	*References*
Restoration of cast-in items	Arrangement of supporting props; fastening of cast-in items, cantilevers, braces	77	63, 70, 86, 106
Concreting of yokes, jackets, splices	Placing of concrete by guniting through holes in slabs by means of side hoppers, boxes, block forms	78	10, 85, 115
Formation of openings in reinforced concrete slabs	Splicing of slabs around the openings; metal framing of openings; positioning of relieving beams	79	67, 68, 69, 70
Stone floors	Setting of ties; splicing from above and below; positioning of relieving beams	80	60, 70, 115
Flights of stairs and stair landings	Splicing; positioning of relieving beams, supporting props	81	58, 70
Balcony slabs and visors	Positioning of cantilevers, relieving beams; setting of substruts, props, suspenders	82	58, 70
Stressing operations in ties	Heating; use of hydrojacks, turnbuckles, bolts, stirrups; wedge driving	83	46, 58, 70, 85
Engagement of strengthened members into joint work	Arrangement of inverted bend, relnforoed conorete yokes, keys; achieving of continuity of members; engagement of lower partitions into work	85	47, 86, 141, 142
Engagement of strengthened members into work	Setting of membrane thrust pads, springs, draw bolts, levers, thrust bolts	86	15,32,34,53, 79,87

Table 1. *(continued)*

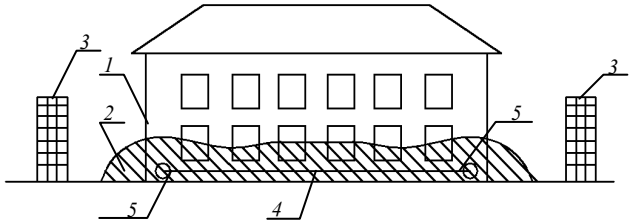
Strengthened members, units and foundation beds	*Ways of strengthening*	*Page*	*References*
Roof and floor slabs	Temporary strengthening; splicing; setting of additional reinforcement; glueing of glasscloth and sheet metal; positioning of relieving beams, ties, substruts	87-93 96-98	7,16,20-22,31,45, 52,60,70,85,86, 92, 93,99,101,103,108, 109,118,122, 127, 129,133, 135, 141
Bearing units of roof slabs and floor panels	Positioning of props by means of welding, tension bars, bolts, stirrups		86, 101
Reconstruction of non-ventilated roofs into ventilated ones	Erection of roof of asbestos corrugated and flat sheets, and of roof iron	94-95	28, 98
Precast floor beams	Splicing; arrangement of jackets, yokes; positioning of posts, substruts, brackets	99	9,16,20,21,31,39, 42,60,64,70,72,78, 86-88,92, 93, 100,
Cast-in-place floor beams	Positioning of relieving beams, brackets, hingerod chains, strutted ties; arrangement of splicing, yokes	100-105	8,16,20,21,70,85, 103,127,129,141, 142
Roof beams	Setting of hinge-rod chains,relieving brackets, relieving beams; achieving of continuity	106-108	18,31,42,62,70, 83,64,85,86,127, 123,136,141,142,
Roof trusses	Setting of ties, hingerod chains; arrangement of reinforced coricrete and metal yokes; achieving of continuity	109-115	31,70,84,127,129, 141,142 70, 84
Bearing units of roof beams and trusses	Positioning of supporting props by means of posts, stirrups, tension bars, plates;	116-118	
List of references		119 120-126	


REASONS RESULTING IN THE NECESSITY OF STRENGTHENING REINFORCED CONCRETE AND STONE UNITS, MEMBERS AND FOUNDATIONS OF BUILDINGS AND STRUCTURES
Reconstruction and reequipment of enterprises, change in social functions of buildings and structures
Errors in design, produotion and handling of building units and members as well as in carrying out building and assembly work
Physical wear of units and members caused by their inten-sive or long use
Units and members damages of all sorts due to breaking of maintenance rules
Units and members wear due to corrosion
Local or overall failures of building members due to temperature influence
Other reasons for units and members damage resulting in the necessity of their streng-thening
Change in geometrical dimensions of sections or units as a whole, as well as change in original work scheme
Increase in loads acting on units and members
Atmospheric corrosion caused by the influence of air or other moistened gases
Liquid or electrolytic corrosion (acid, alkali, salt, sea-water)
Soil or underground corrosion of units and members located underground
Electrical corrosion arising as external current corrosion or leakage-current corrosion
Biologloal corrosion due to the influence of microorganisms or the products of their activity
Influence of high temperatures
Influence of natural calamities (earthquake, wind, hurricano, snow storm, flood, etc.)
Influence of crashes, explosions or impact
Other influences
Influence of low temperatures
Crevice corrosion ocurring in chinks and clearances between building units


WAYS OF STRENGTHENING REINFORCED CONCRETE AND STONE MEMBERS AND FOUNDATIONS IN BUILDINGS AND STRUCTURES
Rehabilitation of building members bearing capacity
INCREASING OF BEARING CAPACITY OF BUILDING MEMBERS
Relieving the building members
Rehabilitation of building members net section area (patching of cracks, bugholes, defects, etc.)
Rehabilitation of cast-in items, loops, fasteners, etc.
Protection from wetting and air agressive environment, maintanance of normaltemperature-moisture conditions in building and structures
Increasing the foundation material strength
Other measures
Without change in design scheme and stressed state
With change in design scheme
With change in stressed state
Partial
Full
Section yokes
Arrengement of jacket in sections
One-sided splicing
Strengtnening of building members connection joints
Other methods
Additional supports
Metal brackets and sub-struts
Tension bars, reinforced concrete and metal chords
Engagement of separate membersinto joint work
Special measures
Additional horizontal or strutted prestressed reinforcement
Prestressed struts
Prestressed ties and stirrups
Other special cases
Reinforced concrete
Metal
Mortar
Polymer
Composite
Rigid (posts,portals, diagonals, etc.)
Elastic (beams, tension bars, bolts, etc.)
Transfer of load to other members
Replacement of members or change in design schemes
Special cases of strengthening separate units and members

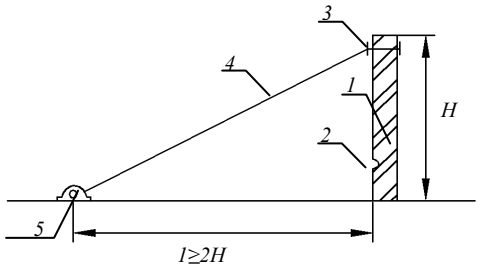
WAYS OF DESTRUCTING CONCRETE. REINFORCED CONCRETE AND STONE MEMBERS IN RECONSTRUCTING BUILDINGS AND STRUCTURES

USE OF EXPLOSION



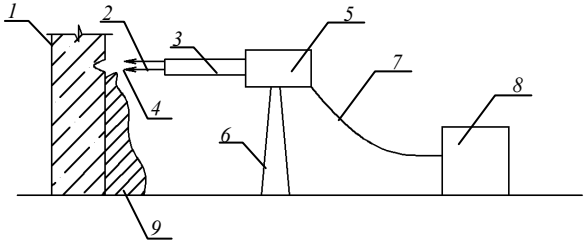
1- building to be destroyed; *2* - destroyed building; *3* - protective screen walls (bales of pressed straw, reed, brushwood, etc., tied by means of steel wire mesh); *4* - protective screen wall made of straw bales or old motor tyres (to protect against soil vibration); *5*- explosives in wall blast holes

STATIC METHOD WITH BUILDING MEMBERS DESTRUCTION TO FOLLOW



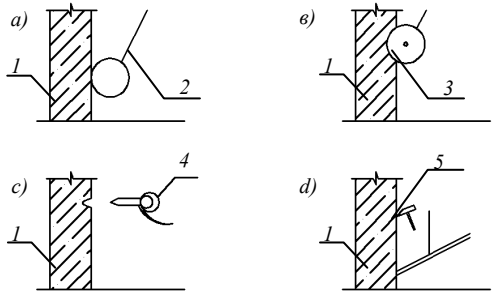
1- member to be destroyed; *2*- notching 1/4 of member thickness; *3*- members in static load application zone (ledgers, distribution traverses, plates, *4*- members transferring load (pulls, stops, beams, posts, etc.); *5*- devices creating static load (winches, jacks, screws, wedges, etc.)

THERMAL METHOD WITH THE USE OF ELECTRIC ARC OR GAS FLOW (“OXYGEN LANCE")



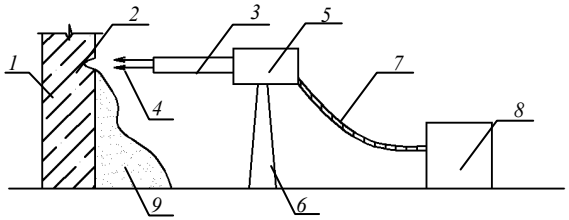
1 - member to be destroyed; *2* - holes, joggles; *3* - graphite (coal) electrodes (two main and one auxilliary for arc clamping) or from 17 to 20 mm diameter steel pipe filled with steel rods; *4* - electric arc with 4000 C oombustion temperature or gas flow; *5*-electrode or pile jig;*6*-device for fixing the jig; *7* - multivain copper current pipes or flexible hose; *8* - transformer or oxygen ballons; *9* - melt of destructed member (slag)

MECHANICAL METHOD



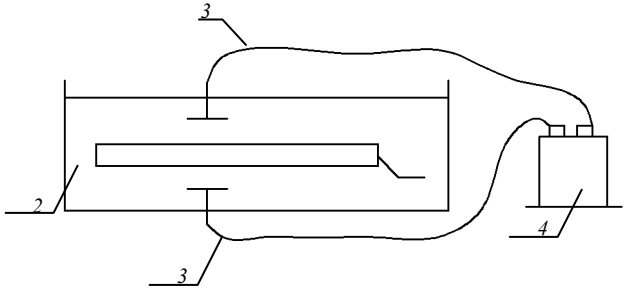
a- crushing in pieces by impact loads;
b- breaking in blocks by out-off disks;
c- breaking in blocks by using small scale mechanization means;
d- breaking in blocks by hand;
1- member to be destroyed: *2*- wedge or ball-hammer; *3*- diamond cut-off disk; *4* - pneumatic or electric hammers; *5*- scrap, pick

HYDRAULIC METHOD WITH THE USE OF WATER JET



1- member to be destroyed; *2* - holes, joggles; *3*- hydraulic gun or hydraulic unit tip; *4* - water jet; *5* - hydraulic gun or hydraulic unit; *6* - device for hydraulic unit fixation; *7* -flexible hose; *8* - water tank; *9* - washed out material of the member to be destructed

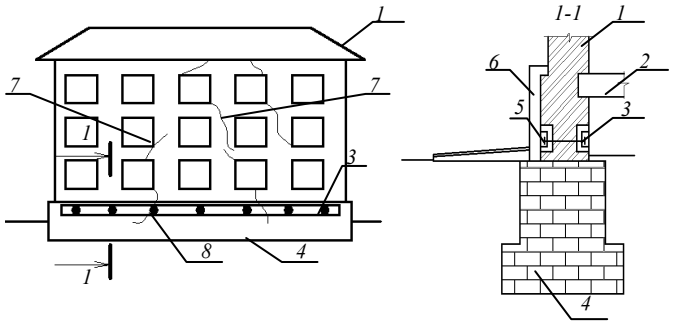
USE OF ELECTRIC DISCHARGE



1- member to be destructed; *2* - water tank into which the member to be destructed is placed; *3* - electrodes (stationary or moving along the member); *4* - condensor

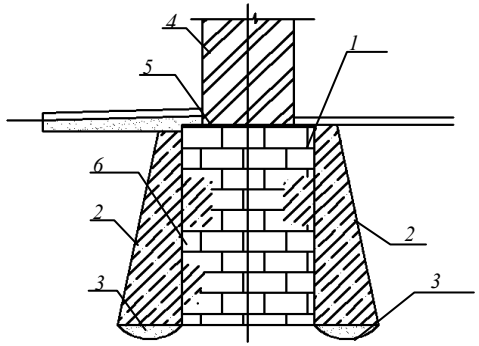
STRENGTHENING OF RUBBLE AND BRICK FOUNDATIONS

UNLOADING OF FOUNDATION WEAKENED PART BY EMBEDING STEEL BEAM INTO WALLS



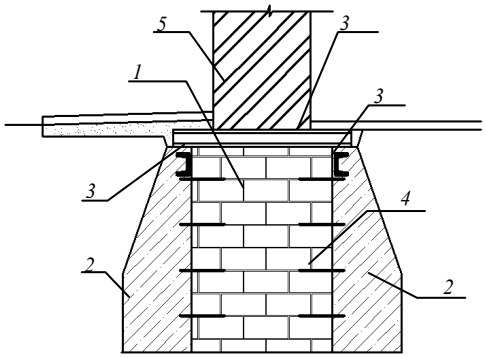
1- brick wall; *2* – floor; *3*-steel beams;
4 - foundation; *5* - joggle in wall; *6* - finishing layer; *7* - cracks in the wall; *8*-anchor

WIDENING OF BEARING AREA BY CONCRETE LUG ARRANGEMENT



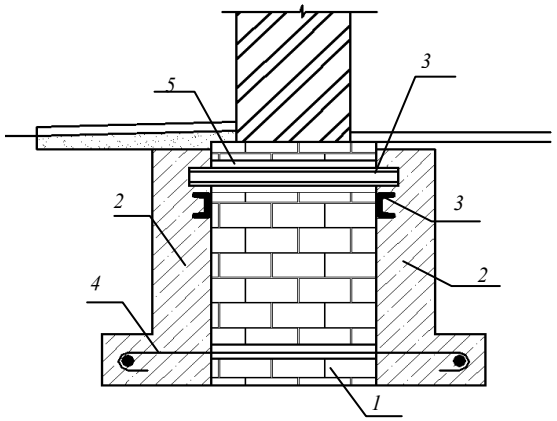
1- existing foundation; *2*- concrete; *3*- packed soil; *4*- brick masonry; *5* - hydraulic seal; *6* - existing foundation outline

WIDENING OF BEARING AREA BY CONCRETE LUGS ARRANGEMENT



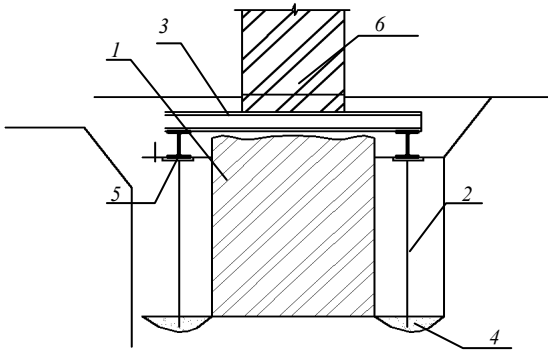
1- existing foundation; *2*- concrete; *3*- metal beam; *4*- metal rods; *5*- brick masonry

INCREASING OF BEARING AREA BY CONCRETE PAD ARRANGEMENT



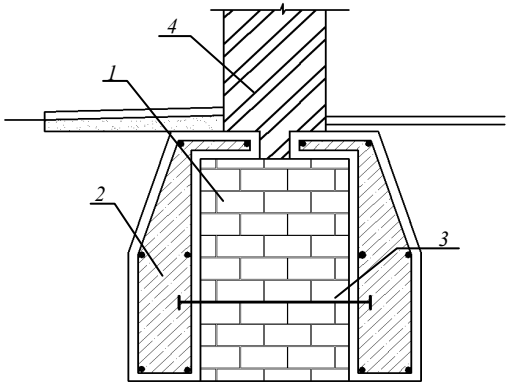
1- existing foundation; *2* - concrete; *3* - metal beam; *4* - anchor; *5*- holes filled with liquid cement mortar under pressure

WIDENING OF BEARING AREA BY ADDITIONAL BRICK MASONRY



1 - existing brick foundation; *2* - additional brick masonry; *3* - metal beam; *4* - packed soil (rammed crushed stone); *5* - metal plates spaced at 0.5 to 10mm in cement-sand mortar layer; *6* - hydraulic seal

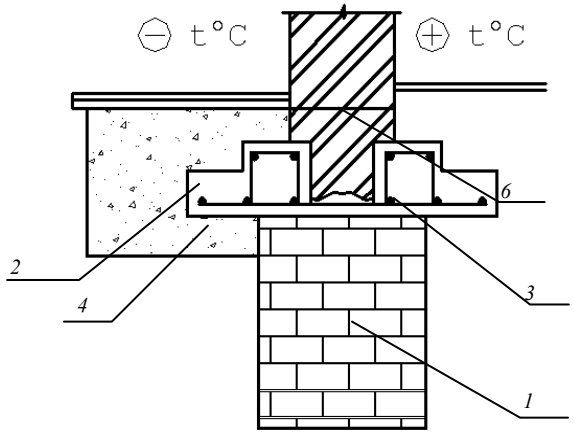
WIDENING OF BEARING AREA AND STABILIZATION OF RUBBLE MASONRY BY MEANS OF REINFORCED CONCRETE YOKE ARRANGEMENT



1- existing foundation; *2*- reinforced concrete yoke; *3*- metal anchor; *4*- brick masonry

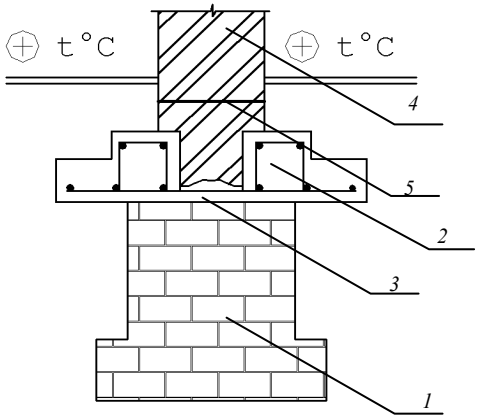
STRENGTHENING OF RUBBLE AND BRICK STRIP FOUNDATIONS

INCREASING OF BEARING AREA BY CAST-IN-PLACE REINFORCED CONCRETE PAD (FOR EXTERNAL WALLS)



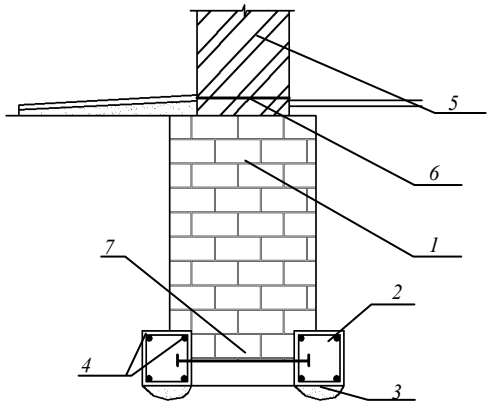
1- existing building; *2*- cast-in-place reinforced concrete pad; *3*- hole filled with cement mortar under pressure; *4*- clydite gravel heater; *5*- brick wall; *6*- hydraulic seal

INCREASING OF BEARING AREA BY CAST-IN-PLACE REINFORCED CONCRETE PAD (FOR INTERNAL WALLS)



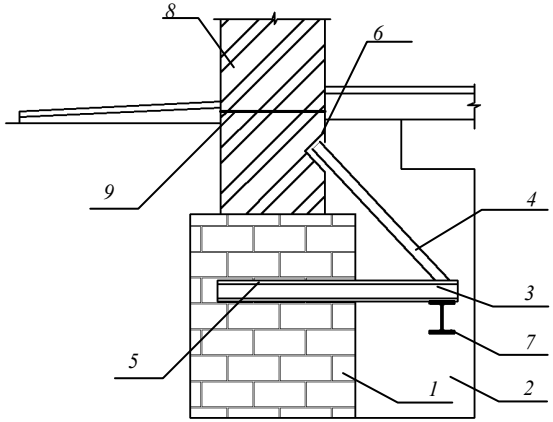
1- existing foundation; *2*- cast-in-place reinforced concrete pad; *3*- hole filled with cement mortar under pressure; *4*- brick wall; *5*- hydraulic seal

WIDENING OF BEARING AREA BY CAST-IN-PLACE REINFORCED CONCRETE LUGS



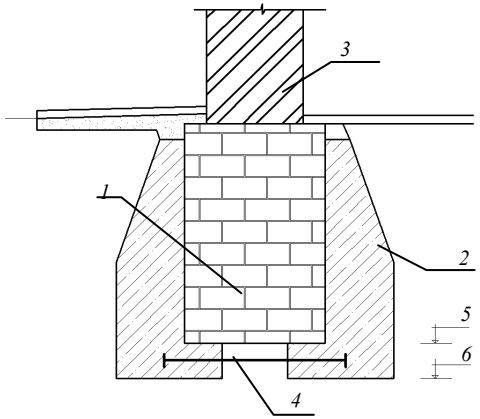
1- existing foundation; *2*- cast-in-place reinforced concrete lugs; *3*- packed soil (rammed crushed stone); *4*- strengthening reinforcement; *5*- brick wall; *6*- hydraulic seal; *7*- reinforcing steel tie

ONE-SIDED INCREASING OF BEARING AREA



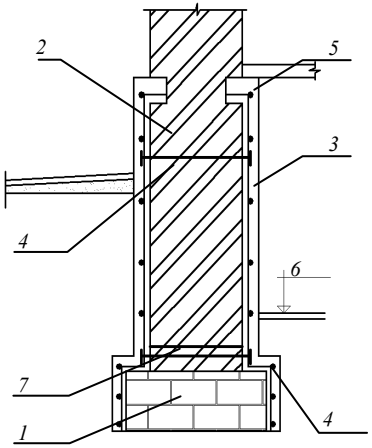
1- existing foundation; *2*- cast-in-place bench; *3*- bearing beam; *4*- sub-strut; *5*- anchor; *6*- stop angle; *7*- spreader beam; *8*- brick masonry; *9*- hydraulic seal

WIDENING OF BEARING AREA AND DEEPENING OF FOUNDATION



1- existing foundation; *2*- concrete; *3*- brick masonry; *4*- anchor; *5,6*- foot marks before and after strengthening the foundation respectively

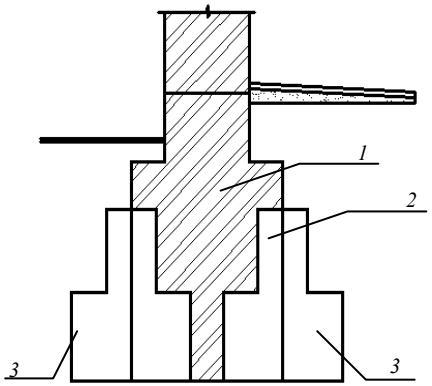
ANCHORING OF BASEMENT WALLS AND FOUNDATIONS BY REINFORCED CONCRETE YOKE



1- existing foundation; *2*- brick wall; *3*- reinforced concrete yoke; *4*- anchors; *5*- superbasement floor; *6*- basement floor mark; *7*- hydraulics seal

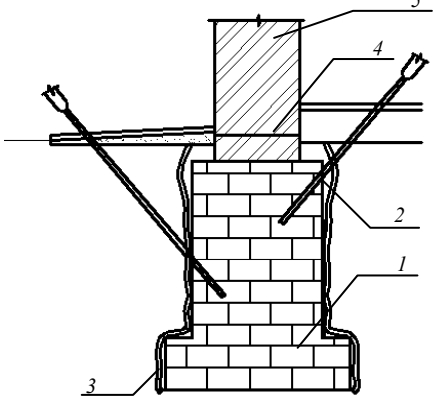
STRENGTHENING OF STRIP FOUNDATIONS

ICREASING OF BEARING AREA BY ADDITIONAL BRICK MASONRY



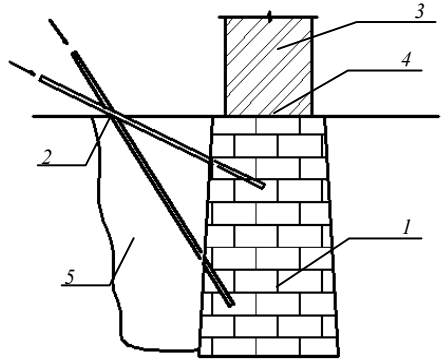
1- existing brick masonry of foundation; *2*- partly disassembled area of existing brick masonry; *3*- additional brick masonry

STABILIZATION OF FOUNDATION RUBBLE MASONRY BY CEMENT INJECTION



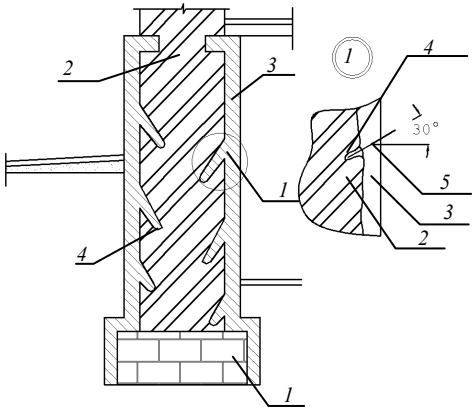
1-existing foundation; *2*- liquid cement mortar injectors; *3* - streaks of mortar; *4*- hydraulic seal; *5*- brick wall

STABILIZATION OF FOUNDATION RUBBLE MASOBRY BY SILICATE-POLYMER MORTAR



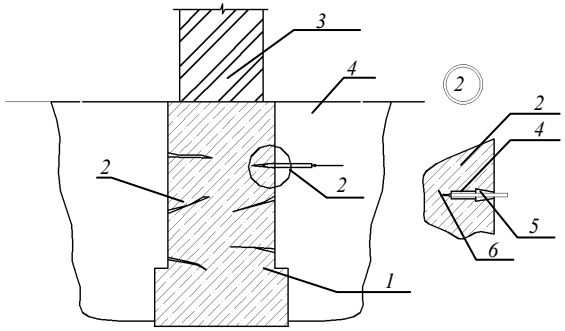
1- existing foundation in bad state (cracks, segregation); *2* - silicate-polymer mortar injectors placed in shot holes or openings; *3* - bick wall; *4* - hydraulic seal; *5* - pit cavity broken up for work on foundation strengthening

ANCHORING OF BASEMENT WALLS AND FOUNDATIONS BY FIBROCONCRETE YOKE



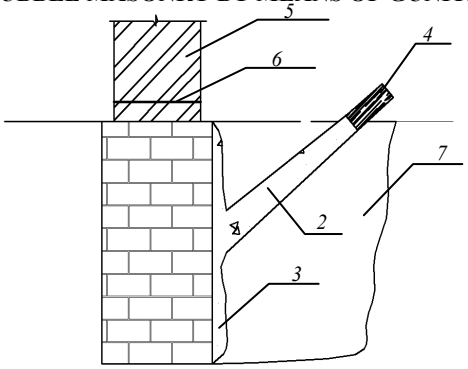
1- existing foundation; *2*- brick basement wall; *3*- fibroconorete yoke; *4*- 20 to 30 mm diameter holes up to 250 mm deep; *5*- periodical profile metal anchors set by means of epoxy adhesive or cement-sand mortar

STRENGTHENING OF CONCRETE (REINFORCED CONCRETE) CRACKED FOUNDATIONS BY MEANS OF SYNTHETIC RESINS



1 - existing foundation with vertical and horizontal cracks; *2* - cracks; *3* - brick wall; *4* - injector for synthetic resins compound injection under 0.6-1 MPa pressure; *5* - groove 35 to 40 mm wide made by disk saw or perforator; 100 to 150 mm deep holes bored by perforator

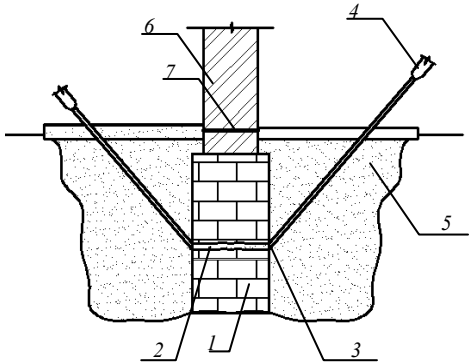
STABILIZATION OF SUBJECTED TO SEPARATION RUBBLE MASONRY BY MEANS OF GUNITE



1- existing foundation with rubble masonry separation; *2* - high pressure concrete spraying; *3*- gunited surface of foundation; *4* - cement gun (or concrete-gun) for concrete mix spraying; *5* - brick wall; *6*- hydra- ulic seal; *7*- broken up pit cavity of foundation

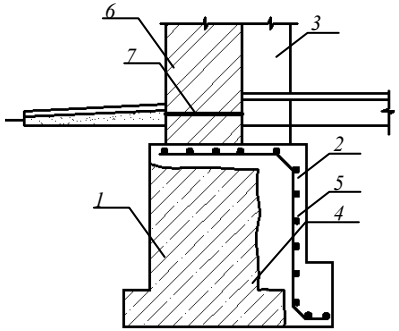
STRENGTHENING OF STRIP FOUNDATIONS

ELIMINATION OF STRIP FOUNDATION RUPTURE



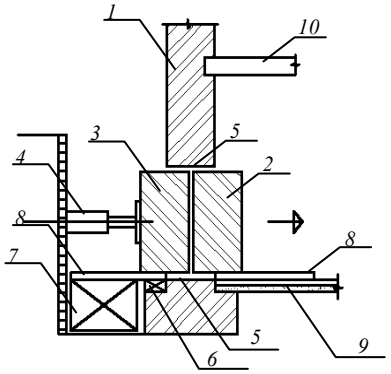
1- existing foundations; *2* - rupture in foundation because of frost heaving; *3*- liquid cement mortar; *4* - injectors; *5* - unheaved soil; *6* - brick wall; *7*- hydraulic seal

ERECTION OF FOUNDATIONS UNDER PILASTERS



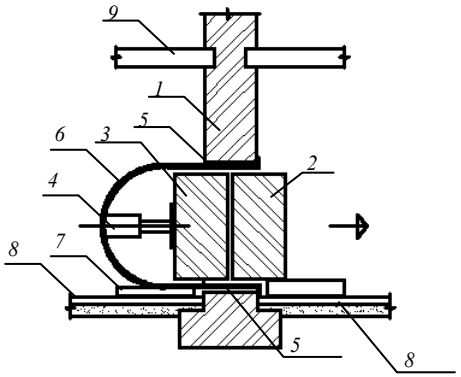
1- existing foundation; *2* - foundation to be spliced under pilaster; *3* - strengthening reinforcement; *4*- prepared surface (hacked); *5* - pilaster; *6* - brick wall; *7* - hydraulic seal

RELAYING OF EXTERNAL WALL STRIP FOUNDATIONS



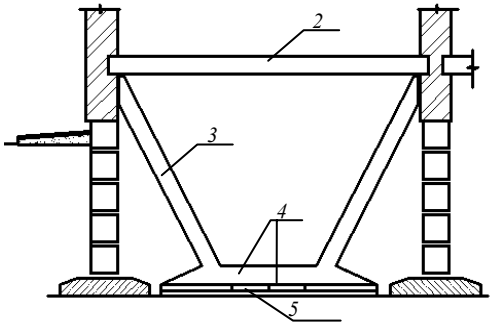
1- existing wall of foundation; *2* - foundation block to be removed; *3* - new block of foundation; *4* - jack; *5* - cut through; *6* - slots; *7* - pads; *8* - scaffolds; *9* - metal slips basement floor; *10* - floor

RELAYING OF INTERNAL WALL STRIP FOUNDATIONS



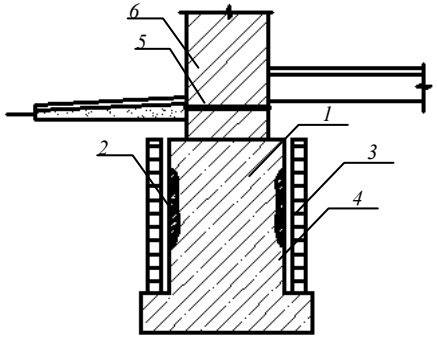
1- existing wall of foundation; *2* - foundation block to be removed; *3* - new block of foundation; *4* - jack; *5* - cut through slots; *6* - cramp; *7* - pads or slips; *8* - basement floor; *9* - floor

INCREASING OF BEARING AREA OF PRECAST STRIP FOUNDATION



1- existing foundation; *2* - floor slab; *3*- cast- in-place reinforced concrete press frame structure; *4* - additional foundation of precast slabs; *5* - packed soil

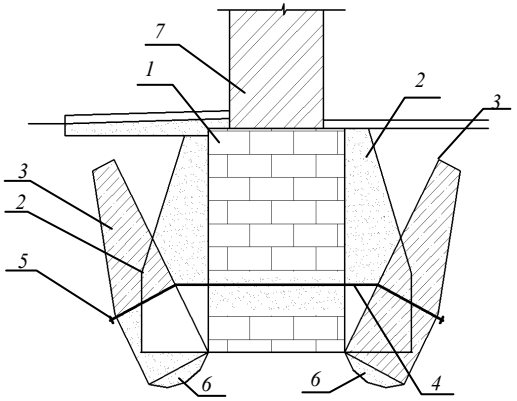
STRENGTHENING OF FOUNDATIONS BY MEANS OF PROTECTIVE WALL ARRANGEMENT



1- existing foundation; *2*- sections damaged due to agressive soil surroundings (raising of soil water level, penetration of chemicals and etc.);*3* - protective brick wall put up after damaged section recovering; *4* - coated or glued hydraulic seal; *5* - horizontal hydraulic seal; *6* - brick wall

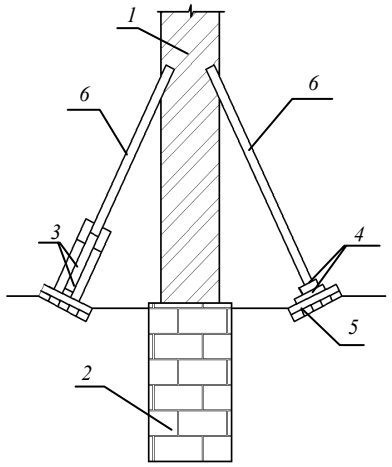
STRENGTHENING OF RUBBLE AND BRICK STRIP FOUNDATIONS

INCREASING OF BEARING AREA BY COMPRESSING FOUNDATION SOIL BY PRECAST REINFORCED CONCRETE ELEMENTS



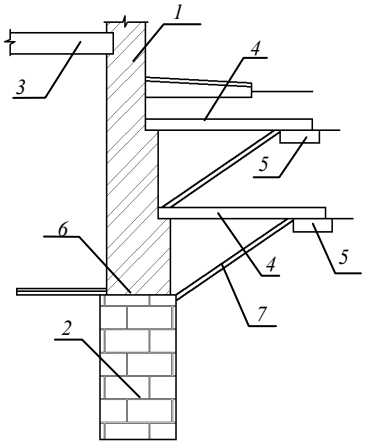
1-existing foundation; *2,3*- elements of widening before and after sliding apart respectively;*4*- hole filled with cement-sand mortar under pressure; *5*- anchor; *6*- packed soil zone; *7*- brick masonry

SUSPENSION OF BUILDING PARTS ON SUBSTRUTS FOR FOUNDATION REPLACEMENT



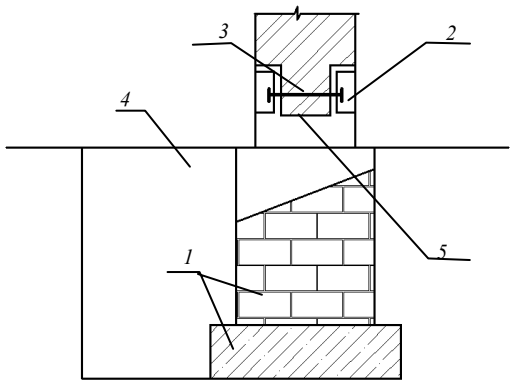
1- brick wall; *2*- foundation; *3*-jacks; *4*-wedges; *5*-pads; *6*- sub-struts

SIDE PRESSURE UNLOADING OF FOUNDATION BY MEANS OF UNLOADING DEVICES



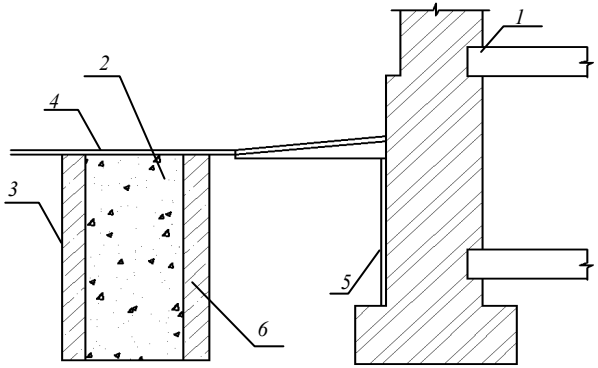
1- brick wall; *2*-foundation; *3*-floor; *4*-reinforced concrete slabs acting as relieving elements ;*5*- pads; *6*-hydraulic seal; *7*- strengthened soil course

REPLACEMENT OF FOUNDATIONS UNDER WALLS BY USING RELIEVING BEAMS



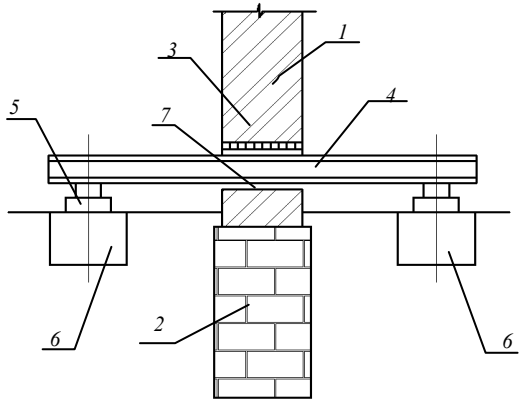
1-supplied foundation; *2*- relieving beams; *3* - coupling bolt; *4*- pit; *5*-brick wall

SIDE PRESSURE UNLOADING OF FOUNDATION WALLS BY MEANS OF RELIEVING ELEMENTS



1 - brick wall; *2* - trench filled with slag; *3* - fastening of trench walls; *4* – trench covering; *5* - hydraulic seal

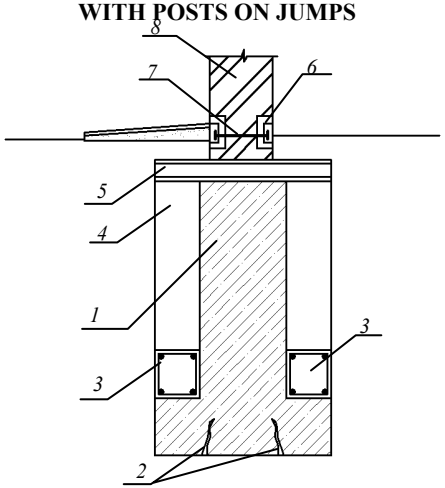
SUSPENSION OF BUILDING PARTS ON LATERAL BEAMS FOR FOUNDATION REPLACEMENT



1- brick wall; *2*- foundation; *3*- pad; *4*- metal lateral beam; *5*- hydraulic jacks (or pads); *6*- temporary supports; *7*- hole in the wall

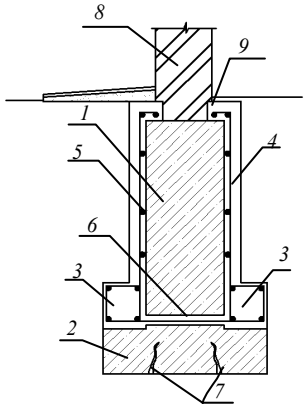
STRENGTHENING OF CAST-IN-PLACE STRIP FOUNDATIONS

ARRANGEMENT OF LONGITUDINAL BEAMS WITH POSTS ON JUMPS



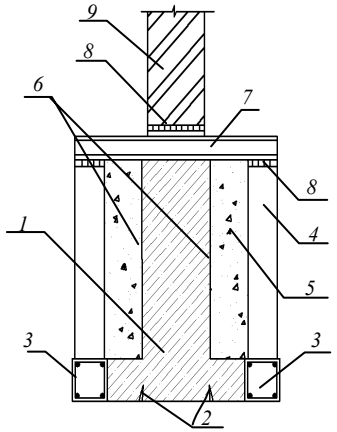
1- existing foundation; *2* - cracks in foundation plate part; *3* - longitudinal reinforced concrete beams; *4*-reinforced concrete posts; *5,6* - metal beams; *7* - coupling bolts; *8*-brick wall

ARRANGEMENT OF LONGITUDINAL BEAMS WITH REINFORCED CONCRETE JACKET ON JUMPS



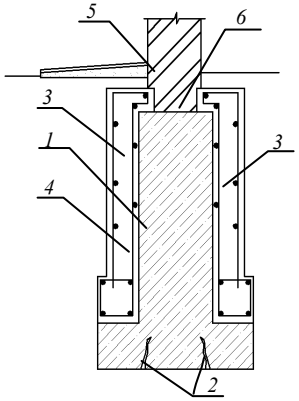
1 - existing foundation; *2* - cracks in foundation plate part; *3* - longitudinal rein- forced concrete beams; *4*- reinforced concrete jacket; *5* - surface prepared for concreting (clean-downed, hacked); *6* - holes filled with liquid cement-sand mortar; *7* - reinforcing steal anchor; *8* - brick wall; *9* - joggle in the wall

INCREASING OF BEARING AREA BY LONGITUDINAL BEAM ARRANGEMENT IN FOOT LEVEL



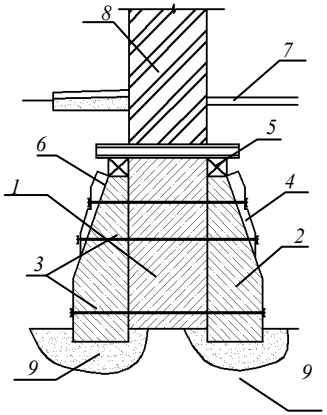
1- existing foundation; *2* - cracks in form of plate part; *3* - longitudinal reinforced concrete beams; *4* - reinforced concrete posts; *5*- cast-in-place concrete; *6* - surface prepared for concreting; *7* - metal beam; *8* - pads; *9* - brick wall

STRENGTHENING OF FOUNDATION PLATE PART BY REINFORCED CONCRETE YOKE



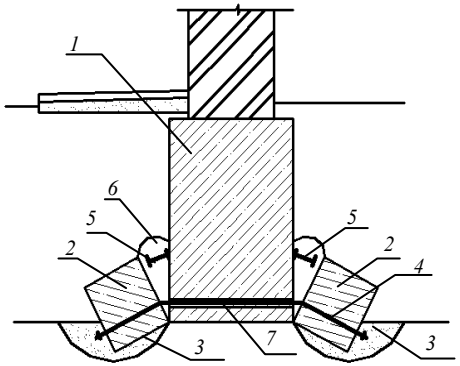
1- existing foundation; *2*- cracks in foundation plate part; *3* - reinforced concrete yoke; *4* - surface prepared for concreting (cleandowned, hacked); *5*-brick wall; *6*-joggle in the wall

INCREASING OF BEARING AREA BY PRECAST ELEMENTS



1 - existing foundation; *2* - precast elements of widening; *3* - fixed tie; *4* - friction covering; *5* - pad-wedges; *6*-recieving shield; *7* - metal beam; *8* - brick wall; *9* - packed soil

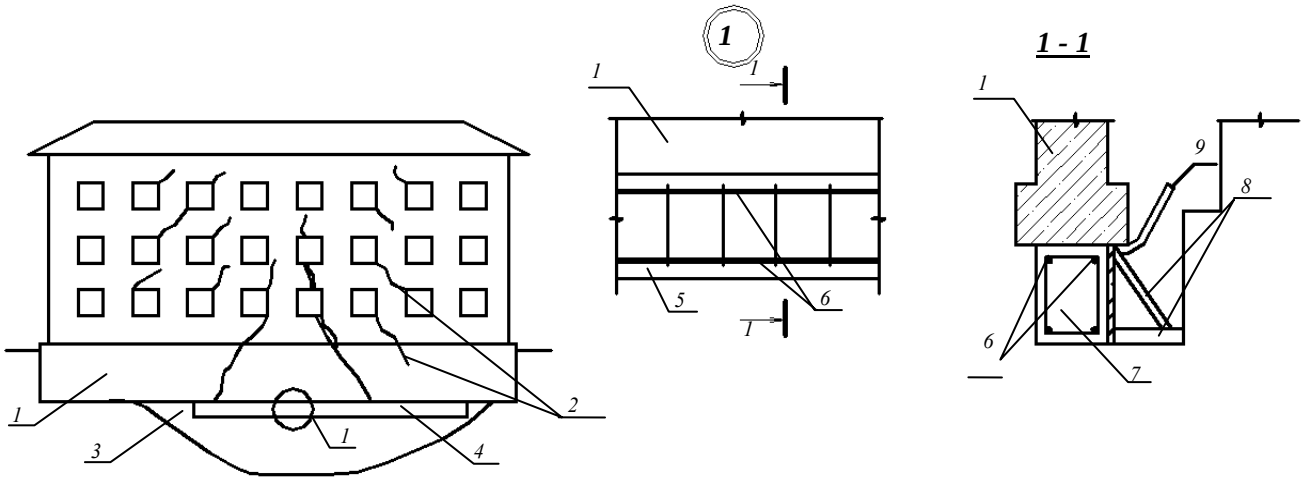
INCREASING OF FOUNDATION BEARING PORTION BY PRECAST ELEMENTS WITH COMPRESSING THE BED SOIL



1 - existing foundation; *2*- elements of bearing area widening; *3* - zones of compressed bed soil; *4* – tie; *5* - device for elements of strengthening compression; *6* - fine aggregate concrete; *7* - hole filled with liquid cement mortar

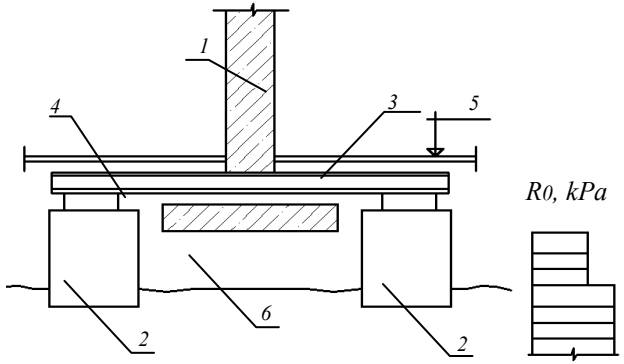
STRENGTHENING OF CONCRETE AND REINFORCED CONCRETE STRIP FOUNDATIONS

UNLOADING OF FOUNDATION WEAKENED PART BY REINFORCED CONCRETE CHORD ARRANGED IN THE BASE



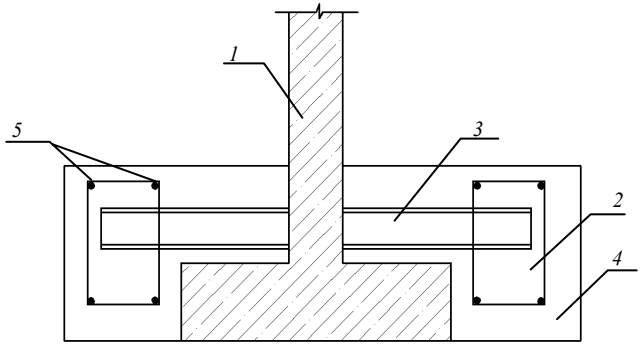
1- existing foundation; *2*- cracks in walls; *3*- set- ting hopper; *4*- cast-in-place reinforced concrete chord; *5*- foundation bed surface; *6*- reinforcing cage; *7*- shield-formwork; *8*- formwork ties; *9*- pipe connection for concrete supply

POSITIONING OF NEW ELEMENTS WITH WEAKENING THE FOUNDATION WALL



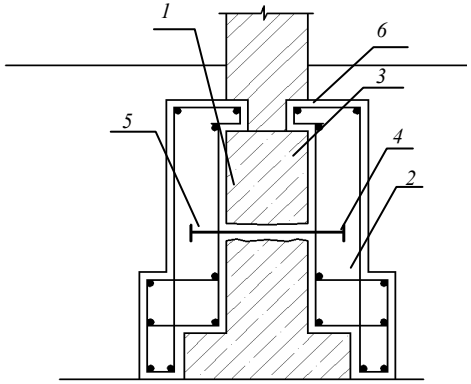
1- cast-in place strip foundation; *2* - additional support-foundations; *3* - strengthening metal beams; *4* - pads; *5* – base-ment floor mark; *6* - soil layer with the highest bearing capacity

WIDENING OF STRIP FOUNDATION FOOT BY MEANS OF CONCRETE LUGS



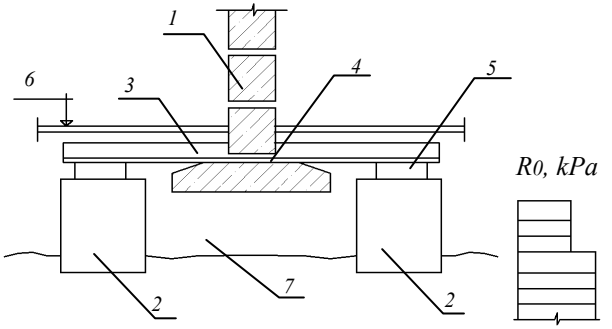
1 - existing foundation; *2* - new part of foundation; *3* - metal beams passed through holes in the wall; *4* - compacted gravel-sand mix (or lean concrete on packed soil); *5* - reinforcement

WIDENING OF FOUNDATION FOOT AND STRENGTHENING OF CONCRETE WALL BY REINFORCED CONCRETE YOKE ARRANGEMENT



1- existing foundation; *2* - reinforced concrete yoke;
3- hole filled with liquid cement mortar; *4* - metal anchor;
5- reinforcement welded to anchor; *6* - joggle in the wall

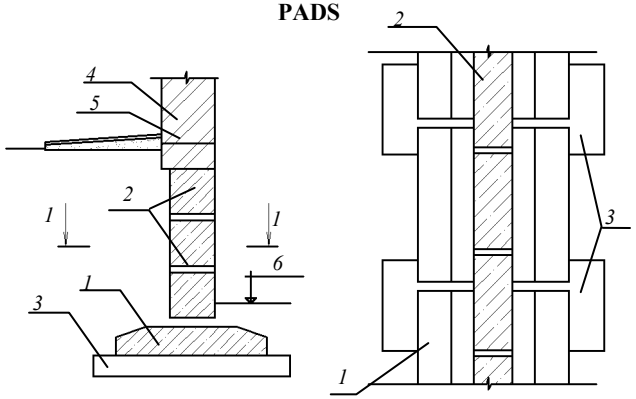
POSITIONING OF NEW ELEMENTS WITHOUT WEAKENING THE FOUNDATION WALL



1- precast strip foundation; *2*- additional foundation supports; *3*- cast-in-place reinforced concrete strengthening beams; *4*- principle reinforcement of beams; *5* - pads; *6* - basement floor mark; *7*- soil layer with the highest bearing capacity

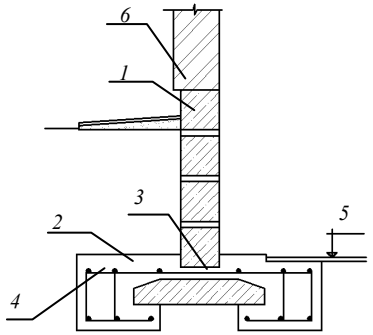
STRENGTHENING OF PRECAST STRIP FOUNDATIONS

INCREASING OF BEARING AREA BY ADDITIONAL PADS



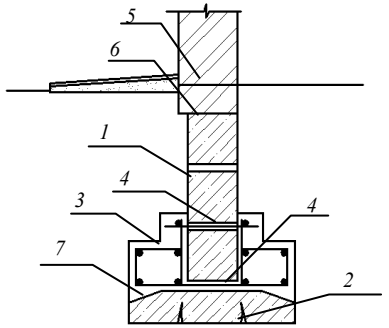
1- pad of existing foundation; *2* - foundation blocks; *3* - cast-in-place reinforced concrete additional pads; *4* - brick masonry; *5* - hydraulic seal; *6* - basement floor mark

INCREASING OF BEARING AREA BY REINFORCED CONCRETE YOKE ARRANGEMENT



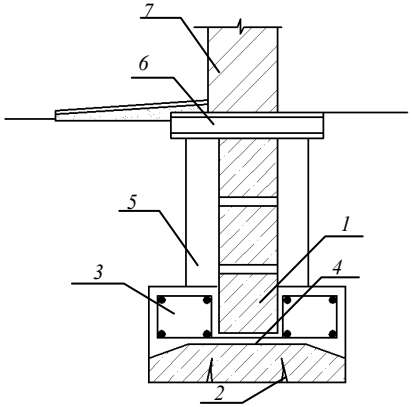
1 - existing foundation; *2* - reinforced concrete yoke; *3* - holes in joints between blocks for placing principle reinforcement; *4*- basic principle reinforcement of strengthening; *5*- basement floor mark; *6* - wall brick masonry

ARRANGEMENT OF LONGITUDINAL BEAMS (SPLICING) ON JUMPS



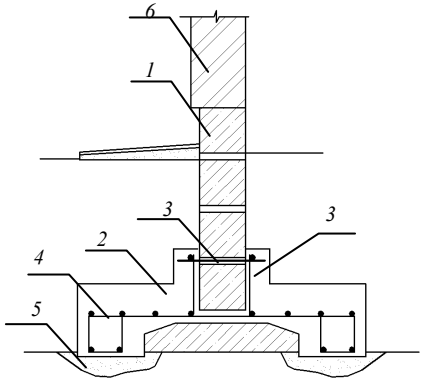
1 - existing foundation; *2* - cracks in foundation plate part; *3* - reinforced concrete splice; *4* - holes in joints between blocks for placing the principle reinforcement (should be filled with liquid cement mortar); *5* - brick masonry; *6* - hydraulic seal; *7* - surface prepared for concreting

ARRANGEMENT OF LONGITUDINAL BEAMS WITH POSTS ON JUMPS



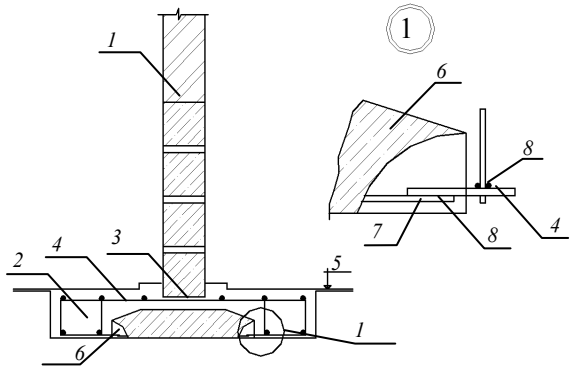
1- existing foundation; *2*- cracks in foundation plate part; *3*- longitudinal reinforced concrete beams; *4* - holes in joints between blocks for placing principle reinforcement; *5* - reinforced concrete posts; *6*- metal beams; *7*- brick wall

INCREASING OF BEARING AREA BY REINFORCED CONCRETE YOKE ARRANGEMENT



1- existing foundation; *2* - reinforced concrete yoke; *3* - holes in joints between blocks for placing principle reinforcement; *4*- basic principle reinforcement of strengthening; *5* - packed soil zones; *6*- wall brick masonry

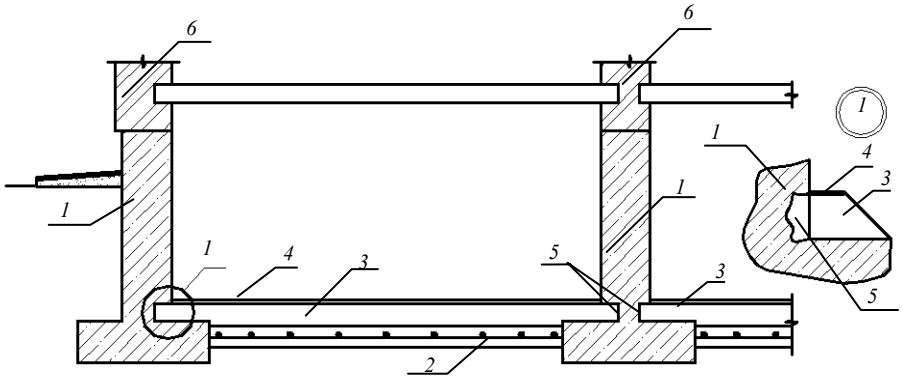
INCREASING OF BEARING AREA BY REINFORCED CONCRETE YOKE ARRANGEMENT



1- existing foundation; *2*- reinforced concrete yoke; *3*- holes in joints between blocks for placing principle reinforcement; *4* - basic principle reinforcement of strengthening; *5* - basement floor mark; *6*- concrete cut off surface; *7*- reinforcement outlets in pad; *8* - welding

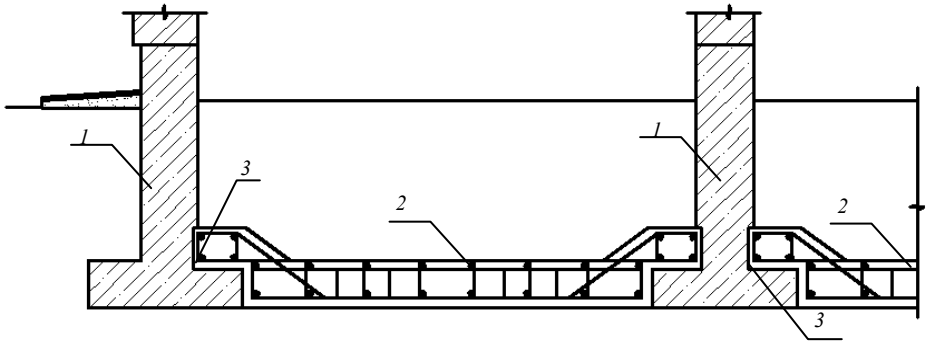
RECONSTRUCTION OF STRIP FOUNDATIONS INTO PLATE FOUNDATIONS

ARRANGEMENT OF CONTINUOUS (INTERRUPTED) PLATE WITH BEAMS BY MEANS OF KEYS



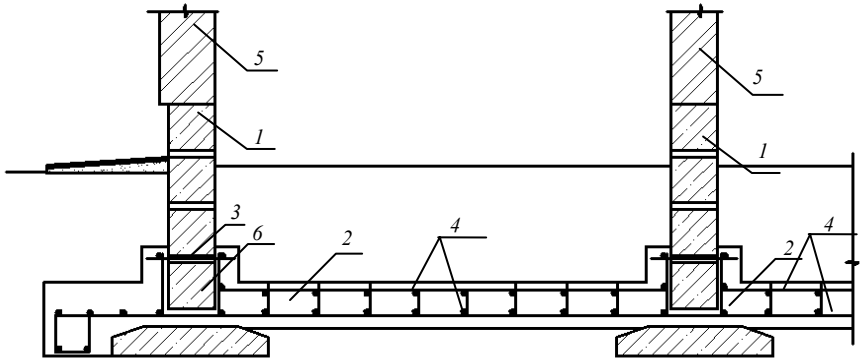
1- existing strip foundations; *2*- continuous (interrupted) plate; *3*- cast-in-place reinforced concrete beams; *4*- basement floor surface; *5*- concrete keys fixed in foundation walls; *6*- brick wall

ARRANGEMENT OF CONTINUOUS (INTERRUPTED) PLATE BY MEANS OF DOWELS



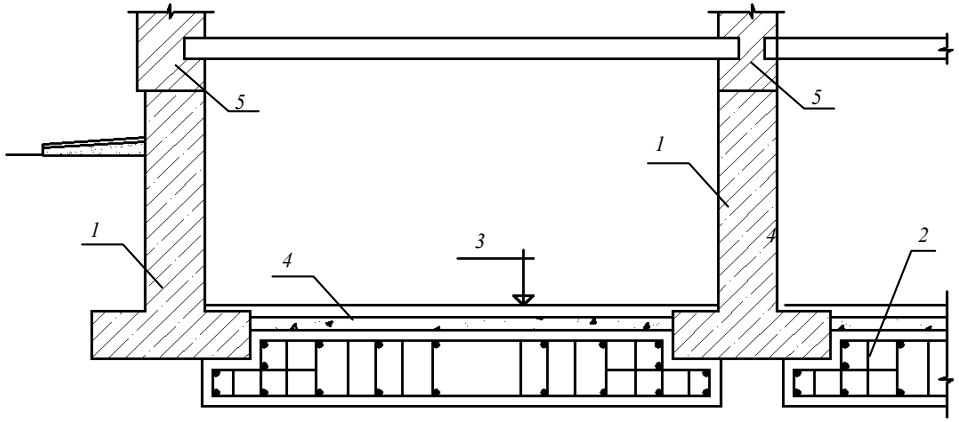
1- existing foundation; *2*- continuous (interrupted) plate; *3*- concrete keys fixed in foundation walls; *4*- brick masonry

ARRANGEMENT OF CORTINUOUS (INTERRUPTED) SPLICING PLATE OVER PADS



1- existing foundation; *2*- continuous (interrupted) plate; *3*- hole in joints between blocks for placing principle reinforcement; *4*- basic principle strengthening reinforcement; *5*- brick wall

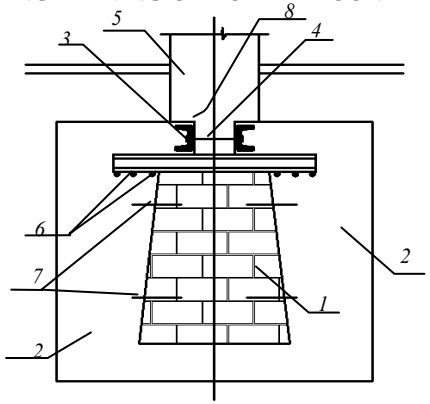
ARRANGEMENT OF CONTINUOUS (INTERRUPTED) PLATE UNDER PADS



1- existing strip foundation; *2*- continuous (interrupted) plate; *3*- basement floor surface mark; *4*- compacted coarse sand; *5*- brick wall

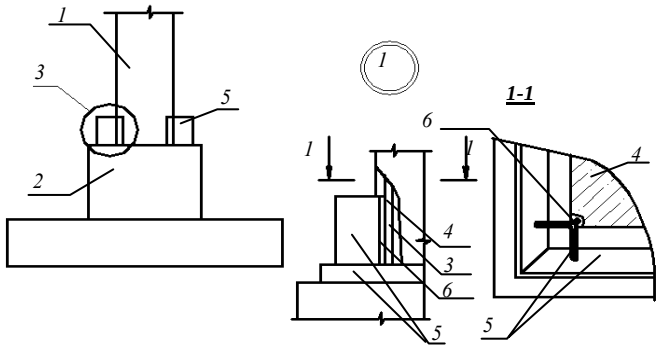
STRENGTHENING OF PAD FOUNDATIONS

INCREASING OF BEARING AREA AND STRENGTHENING OF RUBBLE FOUNDATION



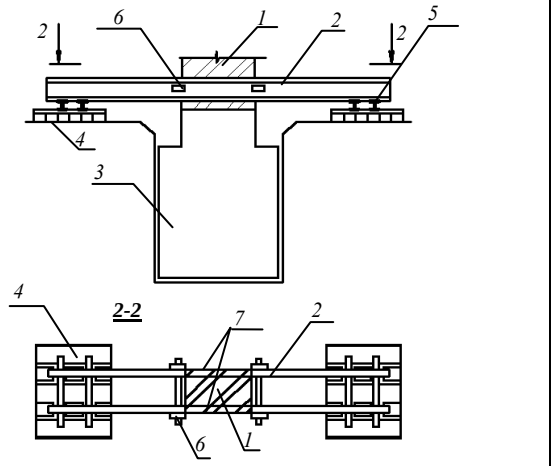
1- foundation under strengthening; *2*- concrete lugs; *3*- metal beams; *4*- coupling bolts; *5*- brick column; *6*- reinforcement; *7*- metal rods; *8*- joggles in column

TRANSFERING A PART OF THE LOAD FROM COLUMN TO FOUNDATION HOUSING WALLS



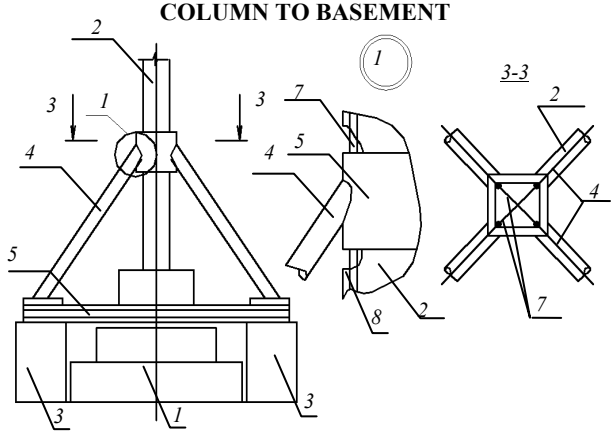
1- reinforced concrete column; *2*- foundation housing; *3*- exposed protective layer; *4*- column principle reinforcement; *5*- metal angles; *6*- welding

SUSPENSION OF BRICK COLUMNS ON BEAMS IN CASE OF PAD FOUNDATION REPLACEMENT



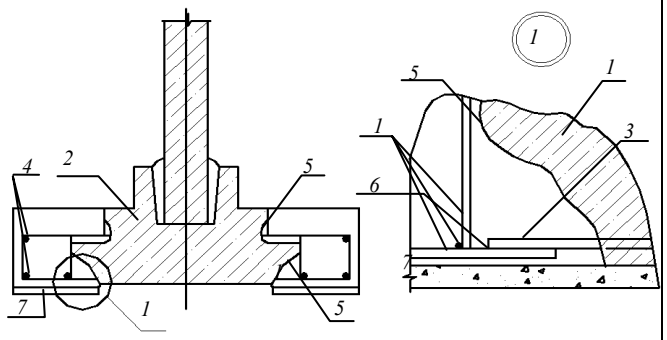
1-brick column; *2*- metal beams; *3*- foundation; *4*- board pads; *5*- metal pads; *6*- coupling bolts; *7*- joggles in column

STRENGTHENING A PART OF THE LOAD FROM COLUMN TO BASEMENT



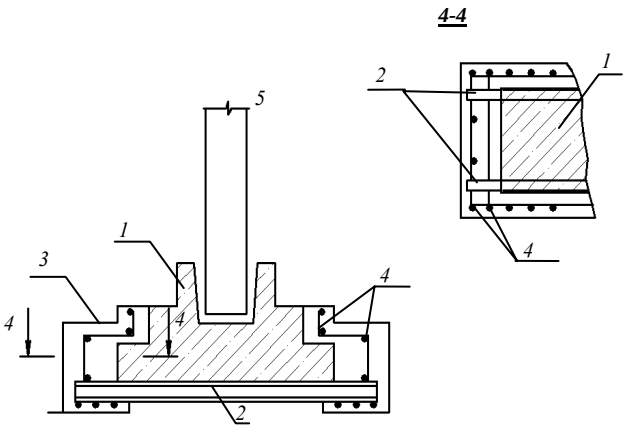
1- foundation under strengthening; *2*-reinforced concrete column; *3*- elements of strengthening the foundation; *4*- metal diagonals; *5*- metal beam; *6*- metal yoke welded to column reinforcement; *7*- column reinforcement; *8*- column portion without protective layer

INCREASING OF BEARING AREA OF REINFORCED CONCRETE FOUNDATION



1- foundation under strengthening; *2*- concrete lugs; *3*- principle reinforcement of existing foundation; *4*- strengthening reinforcement; *5*- concrete spalled surface; *6*- welding; *7*- lean concrete bedding placed on packed soil

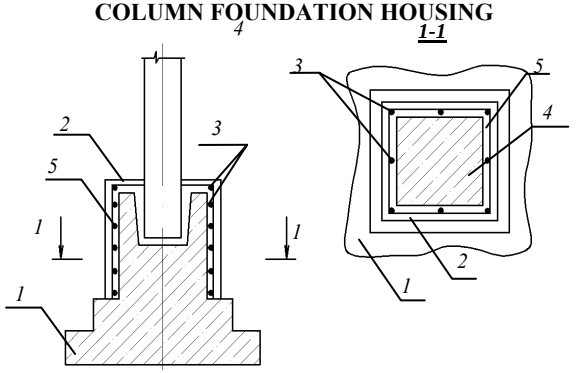
INCREASING THE BEARING AREA OF REINFORCED CONCRETE PAD FOUNDATION



1- reinforced concrete foundation under strengthening; *2*- metal beams; *3*- concrete lugs; *4*- strengthening reinforcement; *5*- reinforced concrete column

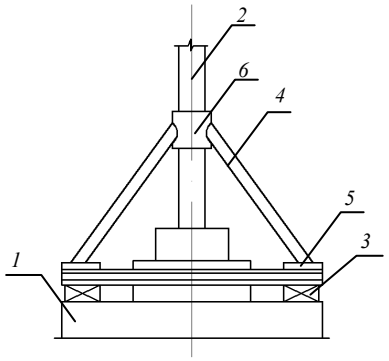
STRENGTHENING OF PAD FOUNDATIONS

ARRANGEMENT OF FIBROUS CONCRETE YOKE ON COLUMN FOUNDATION HOUSING



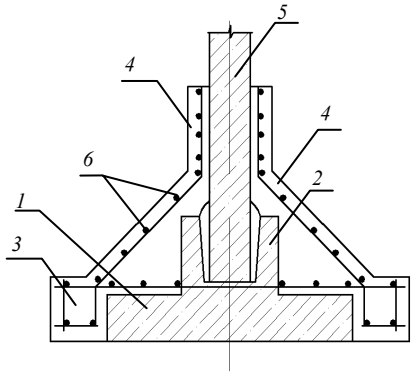
1- reinforced concrete foundation under strengthening; *2*- reinforced concrete column; *3*- fibrous concrete yoke; *4*-foundation surface prepared for concreting (hacked and clean downed); *5*- surface prepared for concreting (clean downed, hacked)

TRANSFERING A PART OF THE LOAD FROM COLUMN TO FOUNDATION OFFSET



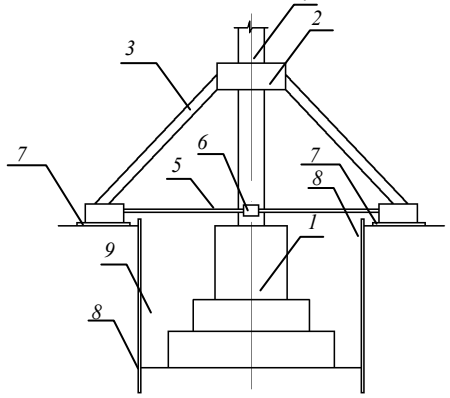
1- foundation under strengthening; *2*- reinforced concrete column; *3*- pads placed on foundation offset; *4*- metal diagonals; *5*-metal beams placed along foundation perimeter; *6*- metal yoke welded to column reinforcement

ARRANGEMENT OF REINFORCED CONCRETE JACKET WITH WIDENING THE FOOT AREA



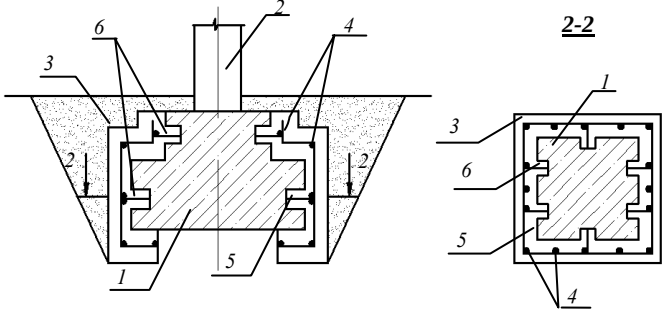
1-foundation under strengthening; *2*- treated surface (hacked); *3*- lean concrete bedding; *4*- reinforced concrete jacket with expanded base; *5*- columns; *6*- strengthening reinforcement

PAD FOUNDATION REPLACEMENT BY OUTRIGGING THE BUILDING COLUMNS BY MEANS OF "SHEARS" DEVICE



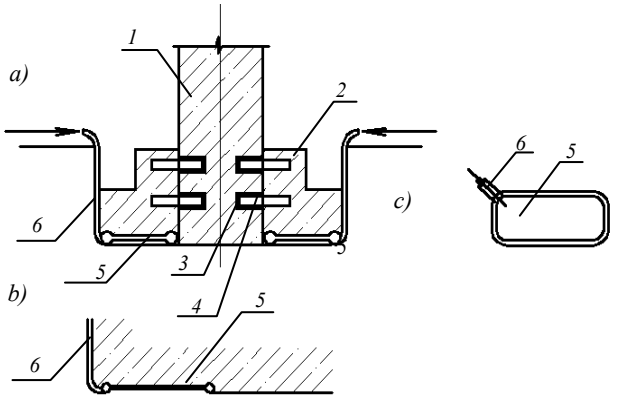
1- existing foundation; *2*- concrete collar; *3*- metal substruts ; *4*- reinforced concrete column; 5-steal tie; *6*- turnbuckle; 7- pads; *8*- enclosing sheeting; *9*- pit cavity filled with soil after laying new foundation

INCREASING THE BEARING AREA OF CONCRETE PAD FOUNDATION



1- existing concrete foundation; *2*- column; *3*- reinforced concrete yoke; *4*- strengthening reinforcement; *5*- jog- gles in the foundation body; *6*- metal rods

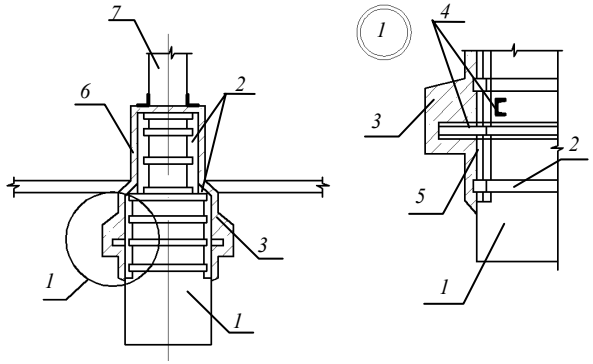
INCREASING THE BEARING AREA OF CONCRETE PAD FOUNDATION BY USING FLAT JACKS



a - scheme of foundation strengthening; *b, c* - details of jack arrangement;
1-foundation under strengthening; *2*- concrete benches; *3*- joggles in foundation; *4*- rolled metal beams; *5*- flat jack; *6*- tube for injecting the liquid into jack

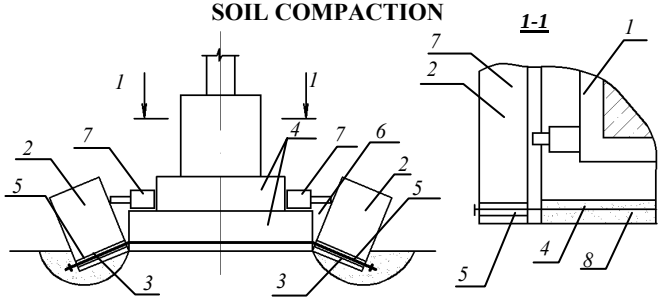
INCREASING OF BEARING AREA AND STRENGTHENING OF CONCRETE FOUNDATION

INCREASING OF BEARING AREA AND STRENGTHENING OF CONCRETE FOUNDATION



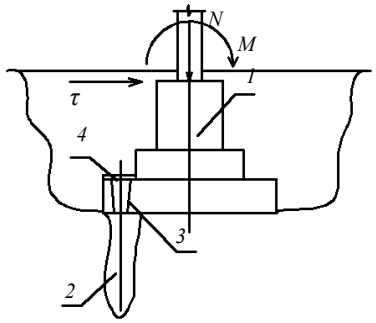
1- existing foundation; *2*- metal yoke; *3*- bench; *4*- bearing beams transfering load to bench; *5*- rod reinforcement; *6*- reinforced concrete yoke; 7- metal angles

INCREASING OF BEARING AREA WITH PRELIMIMARY SOIL COMPACTION



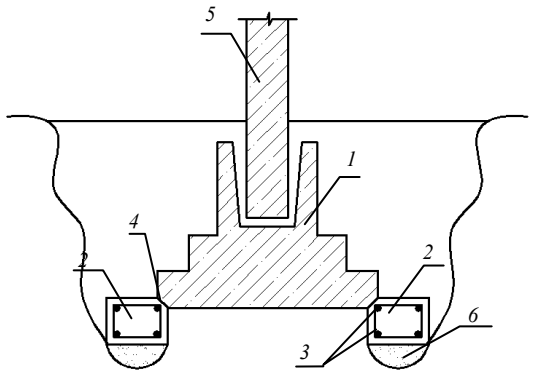
1 - foundation under strengthening; *2* - members (reinforced concrete blocks) used for widening the bearing area; *3*- compressed soil zone; *4* - reinforcing steel anchors; *5* - holes for anchors filled with cement-sand mortar after work completion; *6* - slots formed with blocks turn and filled with fine-grained concrete; *7* - hydraulic jacks (from 2 to 4); *8* - zone to be concreted

ANCHOR STRENGTHENING OF PAD FOUNDATION UNDER THE LOAD WITH CONSIDERABLE ECCENTRICITY



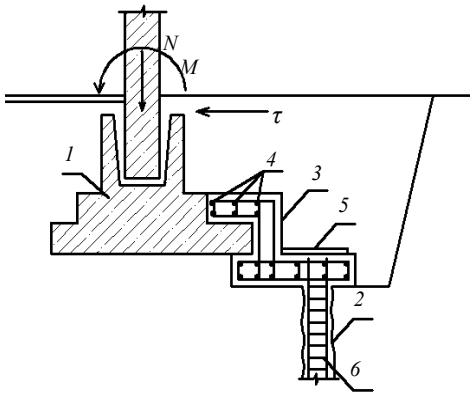
1- pad foundation under streng- thening; *2*- anchors of pull-out reinforced bored piles (pile diameter being from 150 to 200mm, its length being from 2 to 3 m); *3*- cone-shaped holes in foundation plate to be filled with concrete; *4*- metal plates to which anchor reinforcement is welded

INCREASING OF BEARING AREA BY REINFORCED CONCRETE FRAME ARRANGEMENT



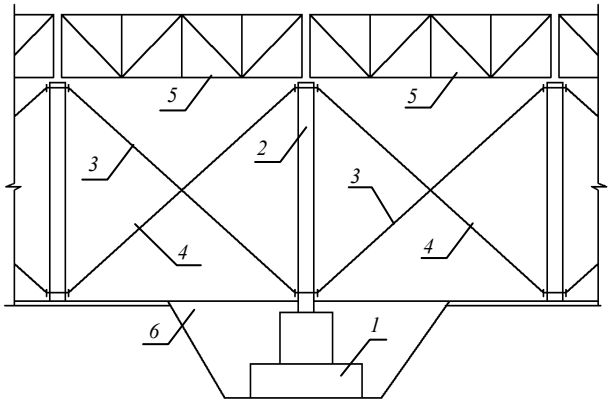
1- pad foundation under strengthening; *2* - cast- in-place reinforced concrete support frame arranged along the perimeter of existing foundation foot; *3* - strengthening reinforcement;*4* - spalls along the perimeter of existing foundation foot; *5* - reinforced concrete column; *6* - compacted soil (rammed crushed stone)

ANCHOR STRENGTHENING OF PAD FOUNDATION UNDER THE LOAD WITH CONSIDERABLE ECCENTRICITY



1- pad foundation under strengthening; *2* - anchors of pull-out bored piles (pile diameter being from 150 to 200 mm, its lengthbeing from 2 to 3 m); *3* - reinforced concrete strengthening element; *4* - strengthening reinforcement placed according to calculation or design; *5* - metal plate with anchor reinforcement welded to it; *6* - reinforcement of anchor piles

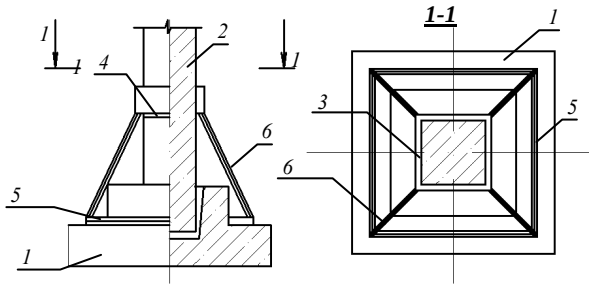
PAD FOUNDATION REPLACENENT BY OUTRIGGING THE COLUMNS BY MEANS OF STRUTTED SYSTEM



1- existing foundation to be replaced; *2* - reinforced concrete column; *3* - strutted elements for outrigging the first portion of columns; *4* - strutted elements for outrigging the second portion of columns; *5* - roof trusses; *6* - pit cavity filled with soil after laying new foundation

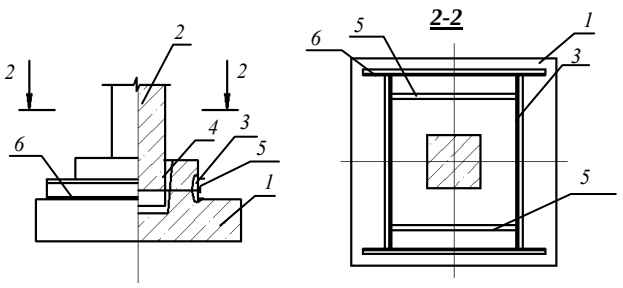
STRENGTHENING OF FOUNDATION PLATE SECTION UNDER COLUMNS

SETTING OF PRESTRESSED SUB-STRUTS



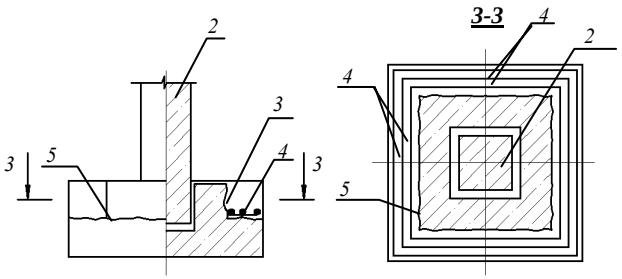
1 - foundation plate section under strengthening; *2* - column; *3* - reinforced concrete or metal yoke on column; *4* - upper angle stud for sub-strut supports; *5* - lower angle stud for sub-strut supports; *6* - angle sub-struts welded to studs after heating the lower stud (stressing operations take place in sub-struts when they are cooled)

PLACING OF RELIEVING CHANNEL BEAMS



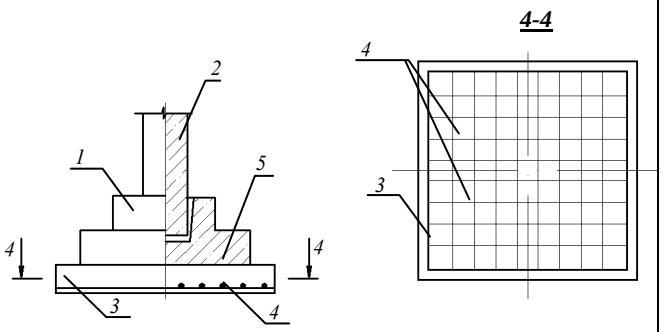
1- foundation plate section under strengthening; *2* - columns; *3* - channel relieving beams placed on mortar in cut out grooves in foundation; *4* - grooves 20 mat deep; *5*- coupling bolts; *6* - channel distribution beams welded to relieving beams after fixing and tightening the bolts); *7* - joint between foundation and strengthening member, wedged out by steel plates and caulked by mortar

ARRANGEMENT REINFORCED CONCRETE SPLICE ABOVE THE FOUNDATION PLATE SECTION



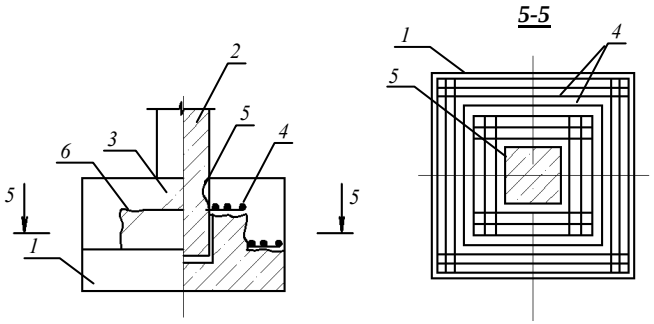
1 - foundation plate section under strengthening (lower jump); *2* - column; *3* - reinforced concrete splice from the top of lower jump; *4* - reinforcement of splice; *5* - foundation surface prepared for concreting (cleandowned and hacked)

ARRANGEMENT OF REINFORCED CONCRETE SPLICE BELOW THE FOUNDATION PLATE SECTION



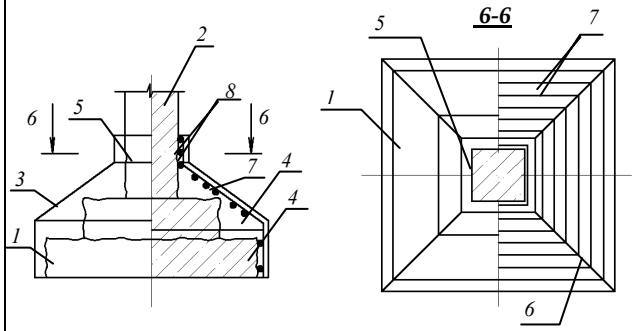
1- foundation under strengthening (unloaded and "suspended"); *2*- column; *3*- reinforced concrete splice from below (after removing the soil under foot); *4*- reinforcing fabric along the splice bottom; *5* - foundation lower surface prepared for concreting (cleared off soil and washed)

ARRANGEMENT OF REINFORCED CONCRETE SLAB ABOVE THE FOUNDATION PLATE SECTION



1 - foundation plate section under strengthening; *2* - column; *3* - reinforced concrete splice above the foundation; *4* – reinforcement of splice; *5* - protective layer of column concrete cut out splice height; *6* - foundation surface prepared for concreting (cleandowned and hacked)

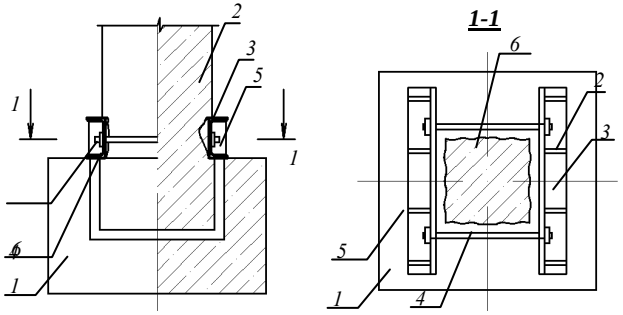
ARRANGEMENT OF REINFORCED CONCRETE JACKET



1- foundation under strengthening; *2*- column; *3*- strengthening reinforced concrete jacket; *4* - horizontal reinforcement; *5* - reinforced concrete yoke on column; *6* - sloping reinforcement of jacket; *7* - horizontal reinforcement of jacket; *8* - yoke stirrups on column; *9* - foundation and column surfaces prepared for concreting (cleandowned and hacked)

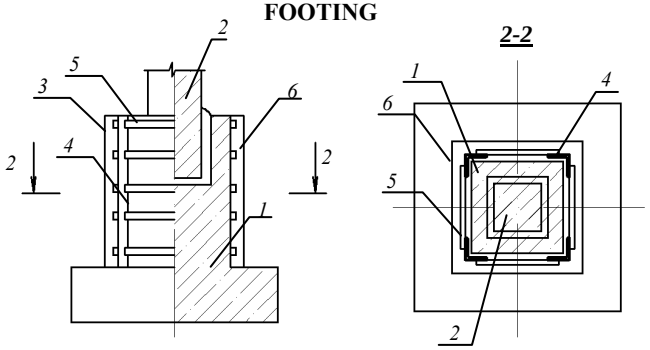
STRENGTHENING OF FOUNDATION AGAINST SPLITTING AND CRUSHING

POSITIONING OF CHANNEL SUPPORTS



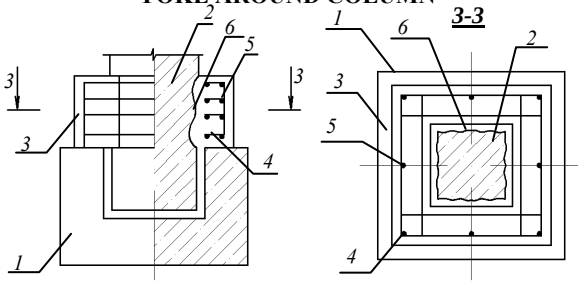
1- column foundation housing; *2* - column; *3-* channel supports placed on mortar in cut out grooves in concrete cover of column; *4-* coupling bolts; *5* - stiffening ribs; *6* - cut out concrete cover of column

ARRANGEMENT OF METAL YOKE AROUND COLUMN FOOTING



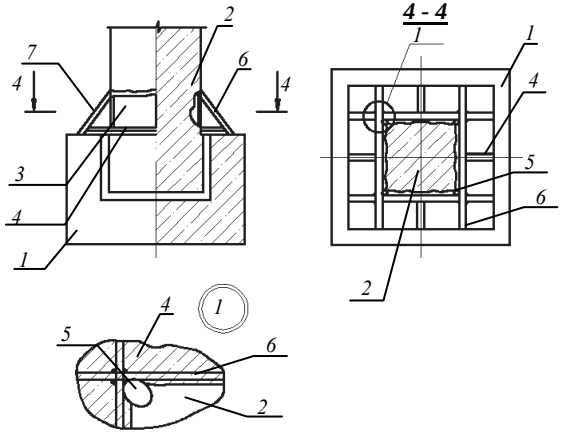
1- column footing part of foundation; *2-* column; *3-* strengthening metal yoke of foundation column footing part; *4-*yoke longitudinal angles placed on mortar; *5-* yoke lateral planks compact cement-sand plastering

ARRANGEMENT OF REINFORCED CONCRETE YOKE AROUND COLUMN



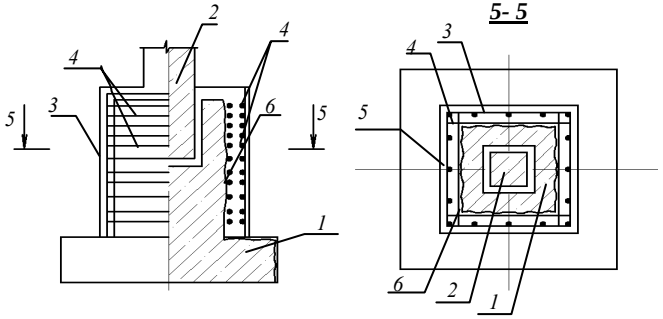
1- column foundation housing; *2* - column; *3* - strengthening reinforced concrete yoke around column; *4* - yoke lateral reinforcing fabrics; *5* - yoke vertical reinforcing rods; *6* - concrete cover of column cut off in yoke arrangement zone

ARRANGEMENT OF METAL YOKE AROUND COLUMN



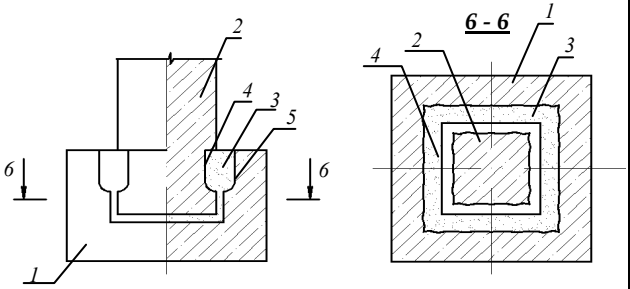
1- column foundation housing; *2-* column; *3-* strengthening metal yoke around column; *4-* supporting plate placed on mortar; *5-* yoke plates placed on mortar in cut out concrete cover of column and welded to column reinforcement; *6* -stiffening ribs; *7-* yoke concreting

ARRANGEMENT OF REINFORCED CONCRETE YOKE AROUND COLUMN FOOTING



1- column footing part of foundation; *2-* column; *3-* strengthening reinforced concrete yoke of foundation column footing part; *4* - yoke lateral reinforcing fabrics; *5-* yoke vertical reinforcing rods; *6* - column footing surface prepared for concreting (cleandowned and hacked)

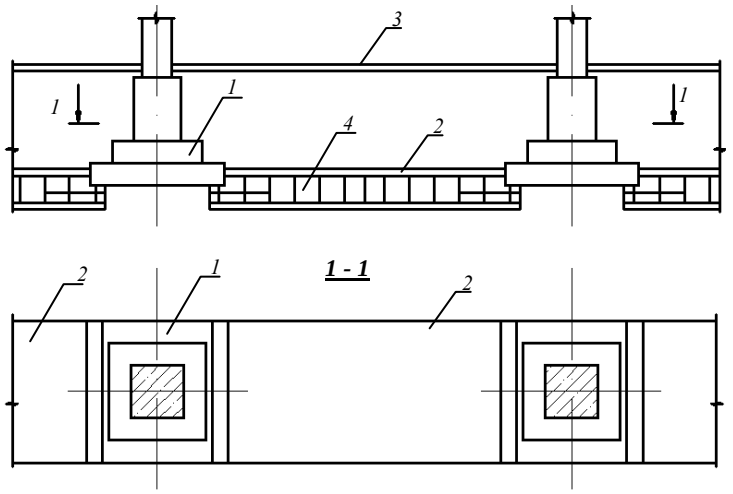
ARRANGEMENT OF CONCRETE KEY



1 - column foundation housing; *2* - column; *3* - concrete dowel; *4* - cut out concrete cover of column; *5* - cut out concrete cover of housing walls

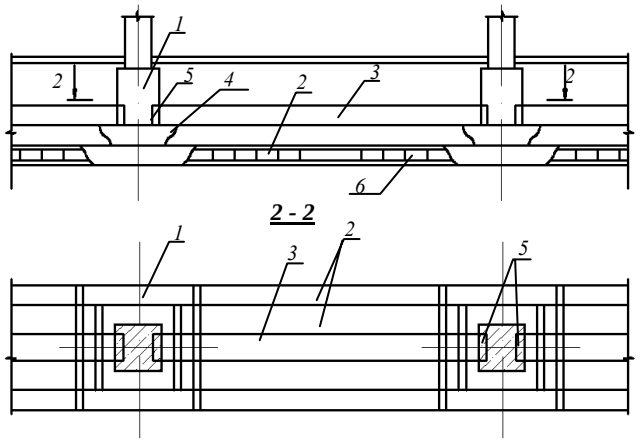
RECONSTRUCTION OF PAD FOUNDATIONS INTO STRIP FOUNDATIONS

ARRANGEMENT OF BULKHEADS BELOW TEE FOUNDATION BEARING PLATES



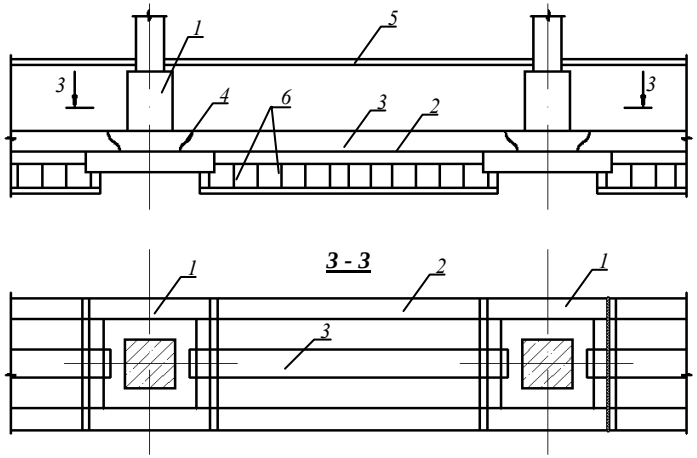
1 - existing pad foundations; *2* - reinforced concrete bulkheads; *3* - floor surface; *4* - reinforcing cage

ARRANGEMENT OF BULKHEADS IN FOUNDATION FOOT LEVEL JOINTLY WITH STIFFENING DIAPHRAGMS



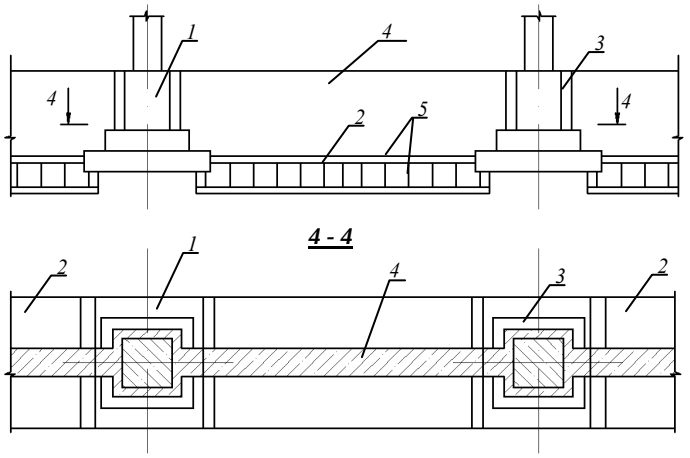
1 - existing pad foundations; *2* - reinforced concrete bulkheads; *3* - stiffening diaphragms; *4* - spalled concrete on foundation plate sections; *5* - pocket for keys in foundation housing; *6* - reinforcing cage

ARRANGEMENT OF BULKHEADS BELOW BEARING PLATES JOINTLY WITH STIFFENING DIAPHRAGMS



1 - existing pad foundation; *2* - reinforced concrete bulkheads; *3* - stiffening diaphragms; *4* - spalled concrete in foundation plate sections; *5* - floor surface; *6* - reinforcing sage

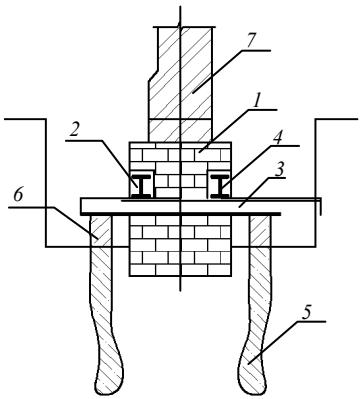
ARRANGEMENT OF BULKHEADS BELOW THE BEARING PLATES JOINTLY WITH STIFFENING DIAPHRAGMS AND YOKES AROUND HOUSING



1 - existing foundations; *2* - reinforced concrete bulkheads; *3* - reinforced concrete yokes; *4* - stiffening diaphragms; *5* - reinforcing cage

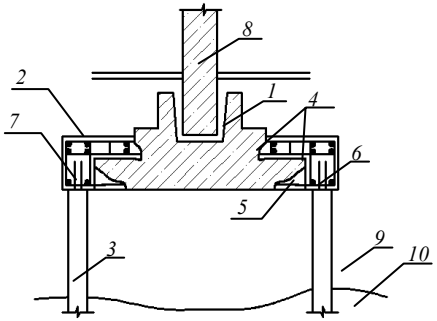
STRENGTHENING OF THE STRIP FOUNDATIONS BY TRANSFERING THE LOAD TO PILES

TRANSFERING OF LOAD FROM WALL TO CAST-IN-PLACE PILES



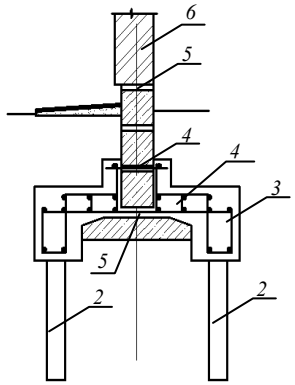
1- foundation under strengthening; *2* - longitudinal metal beams; *3* - lateral metal beams; *4* - cement-sand mortar; *5* - cast-in- place piles; *6* - reinforced concrete stud around piles; *7* - brick wall

TRANSFERING OF FOUNDATION LOAD TO JACKED REINFORCED CONCRETE PILES



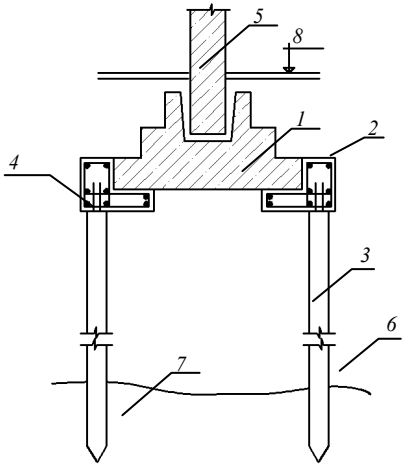
1- foundation under strengthening; *2* - reinforced concrete yoke placed along foundation perimeter; *3* - jacked piles; *4* - concrete spalled surface; *5* - principle reinforcement of existing foundation; *6* - strengthening reinforcement welded to principle reinforcement of existing foundation; *7* - pile protruding bars ; *8* - column; *9,10*- soft and firm soil respectively

TRASSFERING OF LOAD FROM WALL TO SHORT DRIVEN PILES



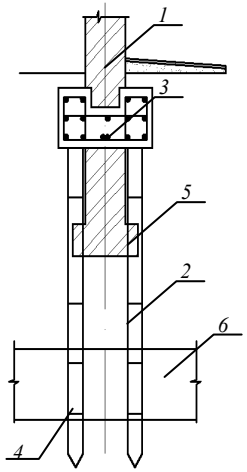
1 - existing strip foundation; *2* - short driven reinforced concrete piles (3 to 4.5m long); *3* - reinforced concrete yoke; *4* - basic principle reinforcement; *5* - hole made in joints between foundation blocks; *6* - brick wall

TRANSFERING OF FOUNDATION LOAD TO JACKED REINFORCED CONCRETE PILES



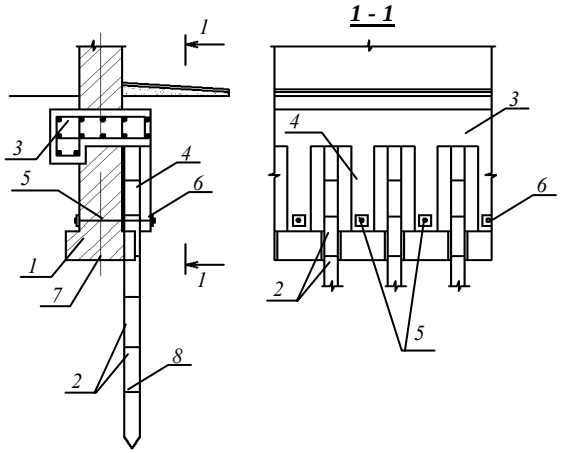
1 - foundation under strengthening*; 2* - reinforced concrete yoke placed along foundation perimeter; *3* - piles; *4* - strengthening reinforcement; *5* - column; *6,7* - soft and firm soil respectively; *8* - surface of floor (base)

TRANSFERING OF LOAD FROM WALL TO SEGMENTAL REINFORCED CONCRETE PILES SUNK BY JACKING



1 - existing foundation; *2* - links of segmental reinforced concrete piles; *3* - reinforced concrete beam put along building wall; *4* - pile butts; *5* - spalled surface of foundation plate; *6* - tunnel

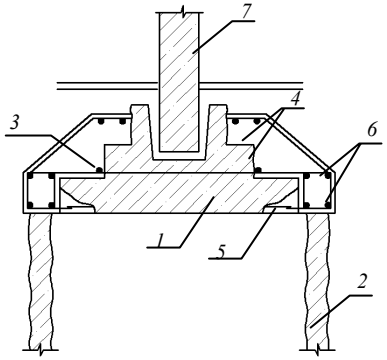
RANSFERING OF LOAD FROM WALL TO SEGMENTAL REINFORCED CORCRETE PILES SUNK BY JACKING



1 - existing foundation; *2* - segmental pile links; *3* - reinforced concrete beam; *4* - reinforced concrete elongation in the form of post*; 5* - metal tension bars; *6* - metal plates; *7*- spalled surface of foundation plate; *8* - pile butt

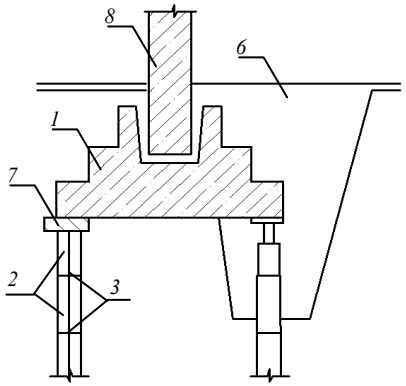
STRENGTHENING OF PAD FOUNDATIONS BY TRANSFERING THE LOAD TO PILES

TRANSFERING OF FOUNDATION LOAD TO BORED PILES



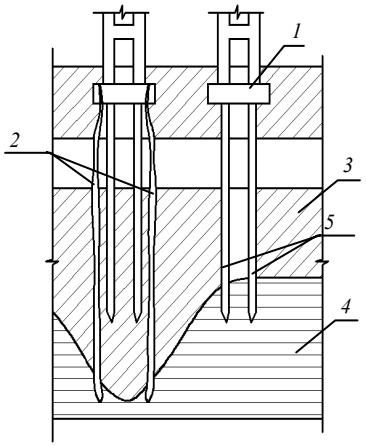
1 - foundation under strengthening; *2* - bored piles; *3*- reinforced concrete yoke; *4* - surface prepared for concreting (hacked, spalled, cleandowned); *5* - principle reinforcement of existing foundation (to be welded to strengthening reinforcement); *6* - strengthening reinforcement; *7* - column

TRANSFERING OF FOUNDATION LOAD TO JACKED SEGMENTAL REINFORCED CONCRETE PILES



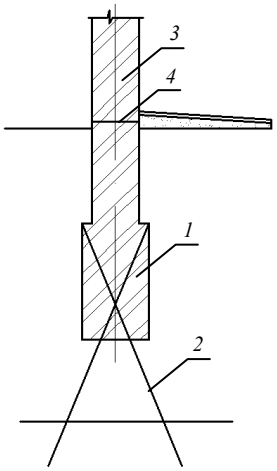
1 - pad foundation under strengthening; *2* - links of segmental reinforced concrete piles; *3* - pile butts; *4* - hydraulic jack; *5* - metal pad; *6* - bore pit; *7* - cast-in-place reinforced concrete plate(to be arranged sectionally after pile jacking); *8* - column

ARRANGEMENT OF BORE INJECTED PILES IN CASE OF EMERGENCY SETTLEMENT



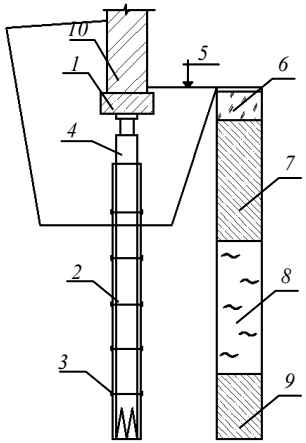
1 - existing foundations; *2* - bore injected piles; *3* - soft hard pressed soil; *4* - firm soils; *5* - driven piles

TRANSFERING OF LOAD FROM WALL TO BORE INJECTION PILES



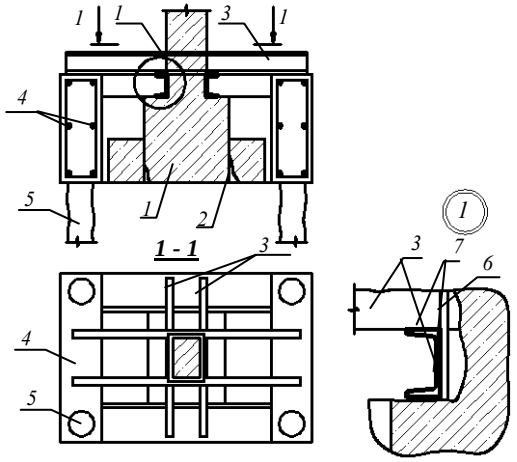
1 - existing foundation; *2* - bore injected piles; *3* - brick wall; *4* - basement floor

SEPARATE LINK JACKING OF METAL TUBE PILES



1 - reinforced concrete foundation under strengthening; *2* - metal tube links 50 mm long; *3* - welding; *4* - hydraulic jacks; *5* - basement floor mark; *6* - filled soil; *7* - soft plastic clay; *8* - mud soil; *9* - lean clay; *10* - brick wall

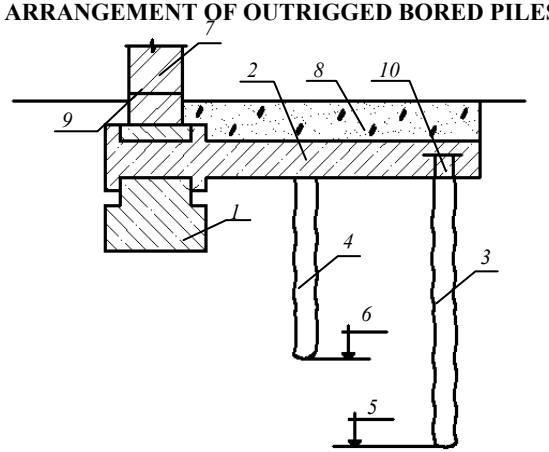
TRANSFERING OF LOAD FROM COLUMN TO BORED PILES



1- existins foundations; *2* - crack in foundation plate; *3* - metal beam welded to column principle reinforcement; *4* - cast-in-place rein- forced concrete stud; *5* - bored piles; *6* - column principle reinforcement; *7*- welding

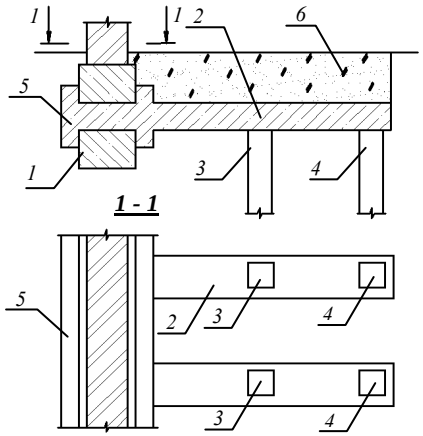
STRENGTHENING OF FOUNDATIONS BY TRANSFERING THE LOAD TO OUTRIGGED PILES

ARRANGEMENT OF OUTRIGGED BORED PILES



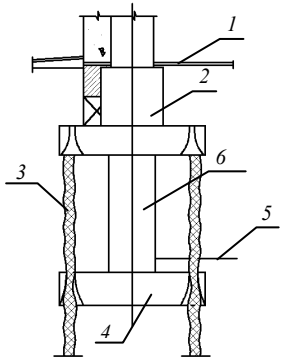
1 - existing unloading foundation; *2* - cast-in-place reinforced concrete beam; *3,4* - pull and compression piles respectively; *5,6* - pile foot marks; *7* - brick wall; *8* - filling; *9* - hydraulic seal; *10* - anchor

ARRANGEMENT OF OUTRIGGED DRIVEN PILES WITH REINFORCED CONCRETE BEAMS



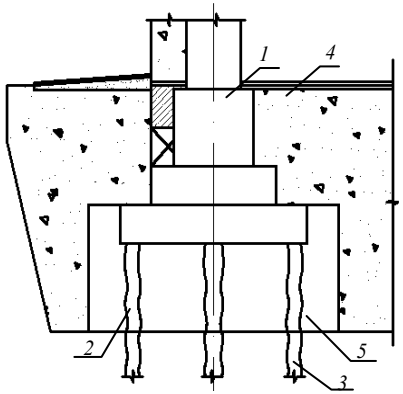
1- unloaded foundation; *2* - cast-in-place reinforced concrete beam; *3* - compression pile; *4* - pull pile (to be arranged with anchor encased in beam); *5* - reinforced concrete chord; *6* - anchor

ARRANGEMENT OF BORE INJECTED PILES IN CASE OF FLOOR LEVEL DEPRESSION IN BUILDINGS



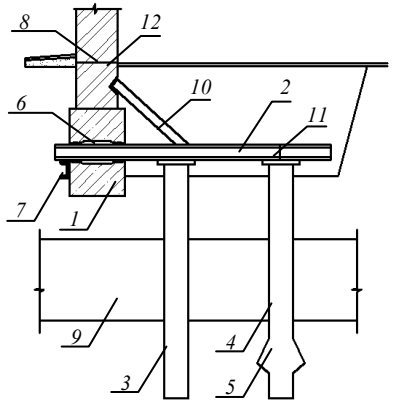
1- existing floor level; *2* - pad foundation position prior to floor level depression; *3* - bore injected piles arranged along the column perimeter (or from two opposite sides); *4* - position of new grillage on design level; *5* - new design position of floor; *6* - new portion of column (after its arrangement piles above grillage level and portion of existing pad foundation should be destructed)

INCREASING THE THICKNESS OF GRILLAGE SLAB PORTION IN CASE OF PILE STRUCTURE FAILURE



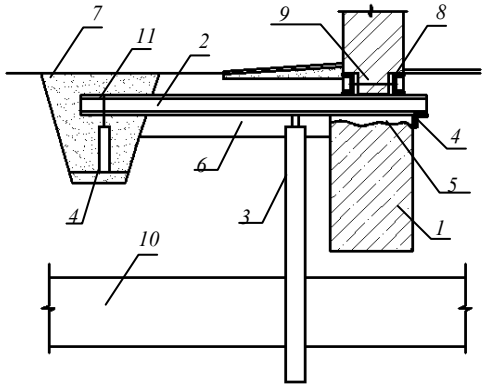
1- foundation under strengthening; *2*- pile portions subjected to failure; *3*-pile portions not subjected to failure; *4*-boring sank for grillage and piles inspection; *5*-area for grouting with B-15 class concrete (for structural reasons A-II class or A-III class reinforcement is placed)

ARRANGEMENT OF OUTRIGGED BORED PILES WITH EXPANDED BASE



1- unloaded foundation; *2*- metal beam; *3*- compression pile; *4*- pull pile; *5*- pile expansion; *6*- hole sealed with concrete; *7*- metal beam- stud; *8*- supporting angle; *9*- tunnel; *10*- sub-strut; *11*- stirrup; *12*- brick wall

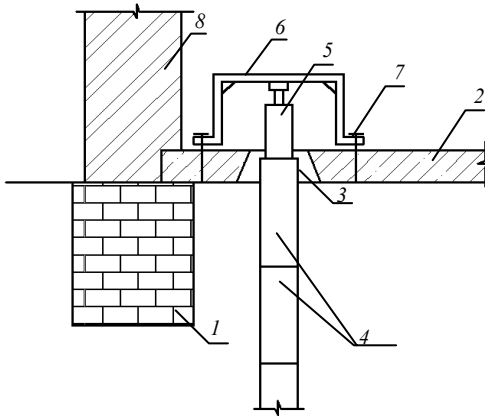
ARRANGEMENT OF OUTRIGGED BORED PILES WITH ANCHORS



1 - existing unloaded foundation; *2* - metal beam; *3* – compression bored pile; *4* - angle metal beam-stud; *5* - hole sealed with concrete; *6* - reinforced concrete plate anchor with metal post; *7* - ballast; *8* - channel purlins; *9* - coupling bolts; *10* - tunnel; *11*- stirrup

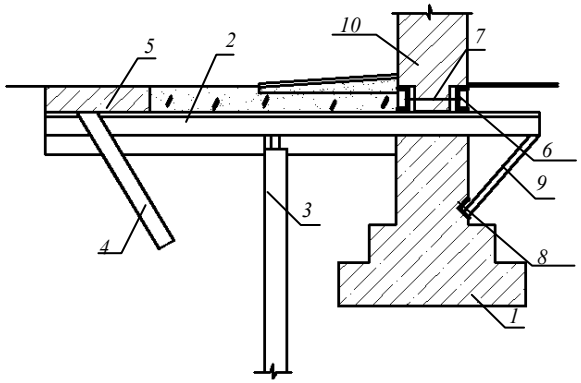
USE OF PILES AND OTHER STRUCTURAL MEMBERS FOR STRENGTHENING THE FOUNDATIONS

SEGMENTAL PILE JACKING THROUGH HOLES IN REINFORCED CONCRETE SLAB



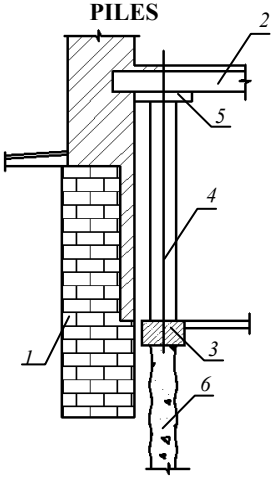
1- strip foundation under strengthening; *2* - cast-in-place reinforced concrete slab; *3* - hole in slab made in concreting the slab; *4* - sections of segmental reinforced concrete pile; *5*- long rod hydraulic jack; *6* - metal stop; *7* - anchor bolts; *8* - brick wall

ARRANGEMENT OF OUTRIGGED BORED (DRIVEN) PILES



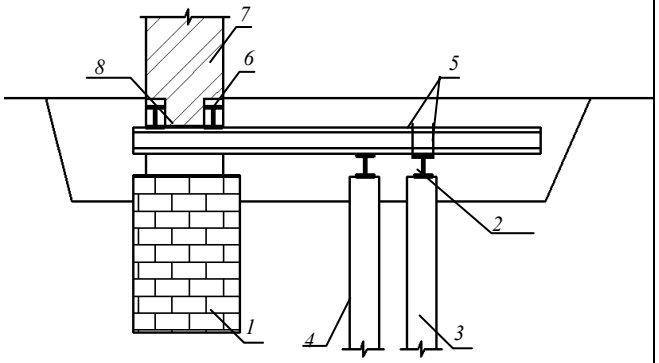
1- existing unloaded foundation; *2*- metal beam; *3*- compression bored pile; *4*- pile- acting as anchor; *5* - ballast; *6*- channel purlins; *7*- coupling bolts; *8* - supporting angle; *9* - metal substrut; *10* - brick wall

TRANSFER OF PARTIAL LOAD FROM FLOOR TO PILES



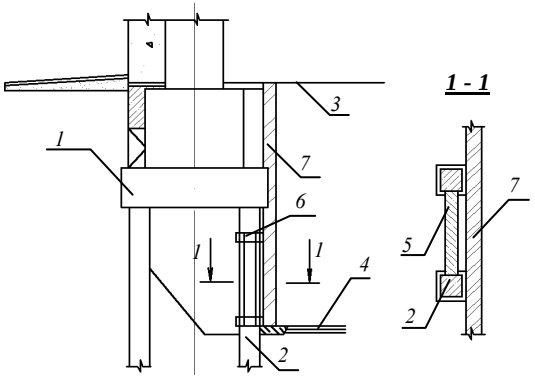
1- existing foundation; *2*- reinforced conc- rete metal floor above basement; *3*-cast-in-place reinforced concrete beam; *4*- column; *5*- metal pads; *6*- bored pile

ARRANGEMENT OF OUTRIGGED DRIVEN PILES WITH METAL BEAMS



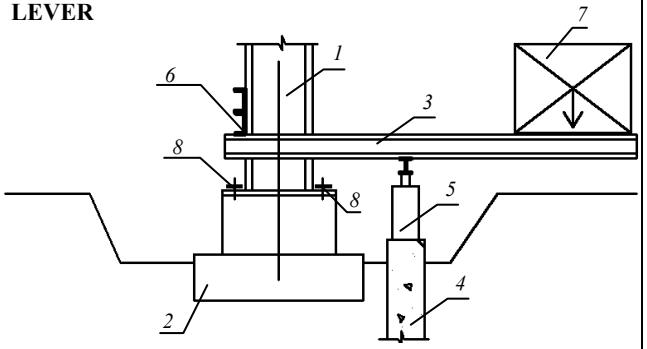
1- unloaded foundation; *2*- metal beam-studs; *3*- pull pile; *4* - compression pile; *5*- stirrups; *6*- longitudinal beams; *7*- brick wall

ARRANGEMENT OF CAST-IN-PLACE REINFORCED CONCRETE DISKS IN CASE OF FLOOR LEVEL DEPRESSION IN BUILDINGS



1- pile foundation grillage; *2*- driven reinforced concrete piles; *3*- floor level prior to its depession; *4*- floor level after its depression; *5*- cast-in-place reinforced concrete disk forspace rigidity of structures; *6* - disk fasteners; *7* - brick enclosure wall

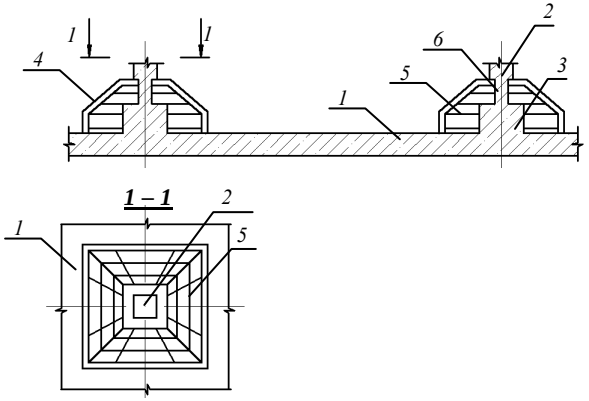
OUTRIGGING OF BUILDING COLUMN BY MEANS OF LEVER



1- outrigged metal column; *2*- existing foundation; *3*- segmental beam-lever for outrigging the column; *4* - bored piles (two) placed near the existing foundation; *5* - hydraulic jack; *6*- support metal beams welded to column; *7*- load of precast members ; *8*- anchor bolts

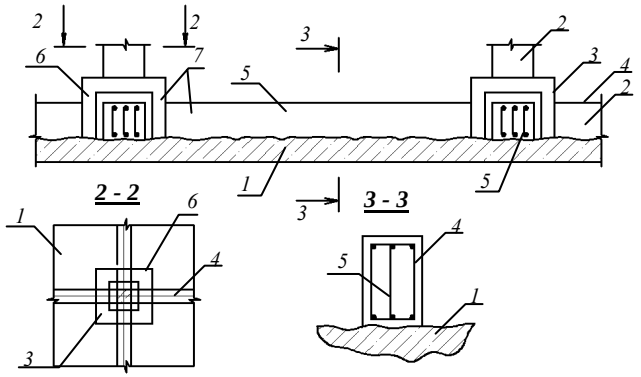
STRENGTHENING OF FOUNDATION PLATES

ARRANGEMENT OF REINFORCED CONCRETE YOKE AROUND FOUNDATION HOUSING



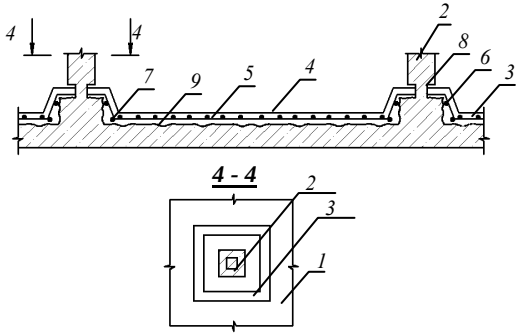
1- plate under strengthening; *2*- reinforced concrete column; *3*- reinforced concrete foundation housing; *4*- reinforced concrete yoke around column and column foundation housing; *5*- yoke reinforcing cage; *6* - column protective concrete layer cut out in yoke zone; *7*- housing and plate surfaces prepared for concreting (cleandowned and hacked)

ARRANGEMENT OF REINFORCED CONCRETE BEAMS ALONG COLUMN LINES



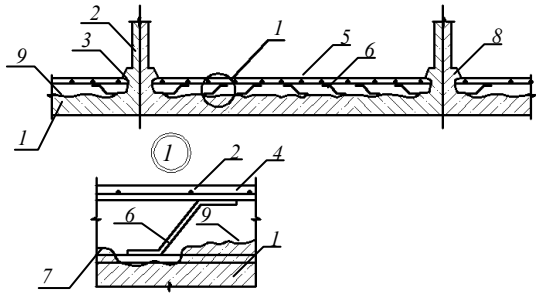
1- plate under strengthening; *2* - reinforced concrete column; *3* - reinforced concrete foundation housing; *4* - strengthening reinforced concrete beams; *5*- reinforcing cages of strengthening beams; *6*-reinforced concrete yoke around columns (supports for strengthening beams); *7*- foundation housing and plate surfaces prepared for concreting (cleandowned and hacked)

SPLICING OF PLATE FROM ABOVE IN CASE OF SUFFICIENT SURFACE BOND



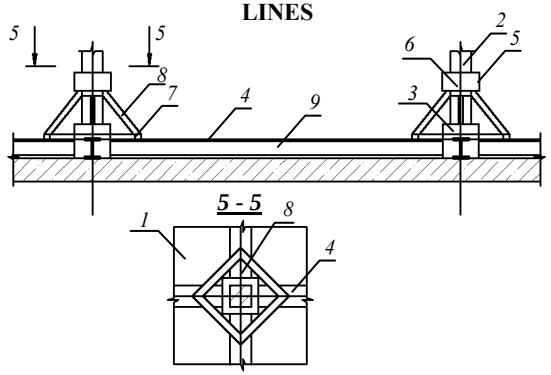
1- plate under strengthening; *2* - reinforced concrete column *3*- reinforced concrete foundation housing; *4*- splice plate; *5*- reinforcing fabric of splice plate; *6*-reinforced concrete yoke around column and foundation housing; *7*- yoke reinforcing cage; *8*- column protective concrete layer cut out in yoke zone for key formation; *9*- foundation housing and plate surfaces prepared for concreting (cleandowned and hacked)

SPLICING OF PLATE FROM ABOVE IN CASE OF INSUFFICIENT SURFACE BOND



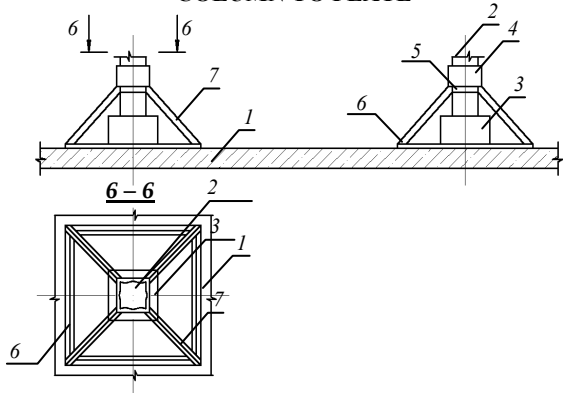
1- plate under strengthening; *2*- reinforced concrete column; *3*- reinforced concrete foundation housing; *4*- splice plate; *5*- reinforcing fabric of splice plate; *6*- reinforcing bent rods welded in chess-board order every O.8 to 1.0 m to plate exposed reinforcement and to splice mesh; *7*- exposed principle reinforcement of plate under strengthening; *8*- protective concrete layer along the housing perimeter for key formation; *9*-plate surface prepared for concreting (cleandowned and hacked)

ARRANGEMENT OF METAL BEAMS ALONG COLUMN LINES



1-plate under strengthening; *2* - reinforced concrete column; *3*-reinforced concrete foundation housing; *4*- strengthening metal beams (double-tees); *5*-reinforced concrete yoke around columns; *6*- angle upper stud; *7*-angle lower stud; *8*- angle sub-struts welded to upper and lower studs (lower stud should be preheated); *9* - mortar alining course under strengthening beam

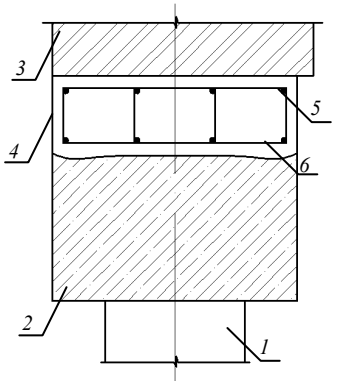
TRANSFERING A PART OF THE LOAD FROM COLUMN TO PLATE



1 - plate under strengthening; *2* - reinforced concrete column; *3* - reinforced concrete foundation housing; *4* - reinforced concrete yoke around column; *5* - angle upper stud; *6* - angle lower stud; *7*- angle sub-struts welded to upper and lower studs (lower stud should be preheated)

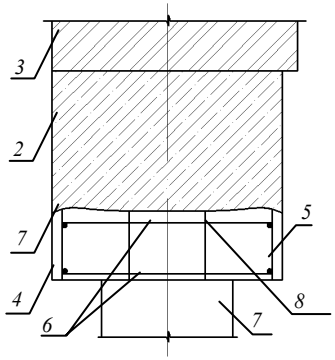
STRENGTHENING OF STRIP GRILLAGES UNDER WALLS

SPLICING OF GRILLAGE FROM ABOVE



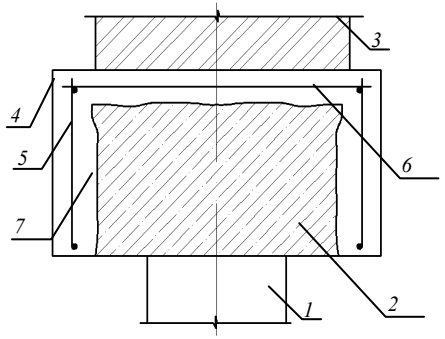
1- reinforced concrete pile; *2*- reinforced concrete grillage under strengthening; *3*- brick (concrete) wall put up before strengthening; *4*- reinforced concrete splice of grillage; *5*- vertical reinforcing cages of splice; *6* - 10 mm diameter concreting rods (of class A-1 reinforcement) spaced at 1.0 m; *7*- grillage surface prepared for concreting (cleandowned and hacked)

SPLICING OF GRILLAGE FROM BELOW



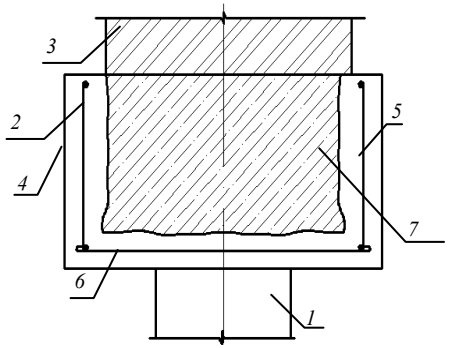
1- reinforced concrete pile; *2* - reinforced concrete grillage under strengthening; *3* - brick (concrete) wall put up before strengthening; *4* - reinforced concrete splice from below; *5* - vertical reinforcing cages of splice; *6* - 10 mm diameter connecting rods (of class A-I reinforcement spaced at 150 mm between piles; *7*- grillage surface prepared for concreting (cleandowned and hacked); *8* - concrete cover cut out along the perimeter

ARRANGEMENT OF REINFORCED CONCRETS JACKET FROM THE RILLAGE TOP



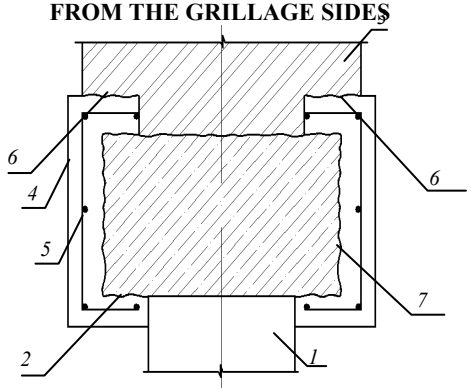
1 - reinforced concrete pile; *2* - reinforced concrete grillage under strengthening ; *3* - brick (concrete) wall put up before strengthening; *4* - reinforced concrete jacket arranged from above; *5* - vertical reinforcing cages of jacket; *6* - 10 mm diameter connecting rods (of class A-I reinforcement) spaced at 150 mm; *7* - grillage surface prepared for concreting (cleandowned and hacked)

ARRANGEMENT OF REINFORCED CONCRETS JACKET FROM THE GRILLAGE BOTTOM



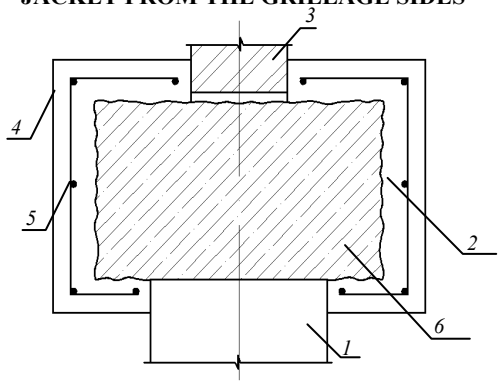
1- reinforced concrete pile; *2*- reinforced concrete grillage under strengthening ; *3*- brick (concrete) wall put up before strengthening; *4*-reinforced concrete jacket arranged from below; *5*- vertical reinforcing cages of jacket; *6*- 10 mm diameter connecting rods (of class A-I reinforcement) spaced at 150 mm; *7*- grillage surface prepared for concreting (cleandowned and hacked)

ARRANGEMENT OF REINFORCED CONCRETS JACKET FROM THE GRILLAGE SIDES



1- reinforced concrete pile; *2*- reinforced concrete grillage under strengthening ; *3*- brick wall put up before strengthening; *4*-reinforced concrete jacket arranged from the *s*ides of grillage ; *5*- reinforcing Π - shaped cages; *6*- grooves out in brick wall for arranging the jacket; *7*- grillage surface prepared for concreting (cleandowned and hacked)

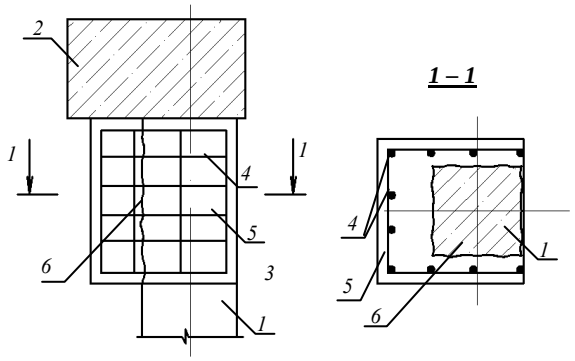
ARRANGEMENT OF REINFORCED CONCRETS JACKET FROM THE GRILLAGE SIDES



1- reinforced concrete pile; *2*- reinforced concrete grillage under strengthening ; *3*- brick (concrete) wall put up before strengthening; *4*- reinforced concrete jacket arranged from the *s*ides of grillage; *5*- reinforcing Π - shaped cages; *6*- grillage surface prepared for concreting (cleandowned and hacked)

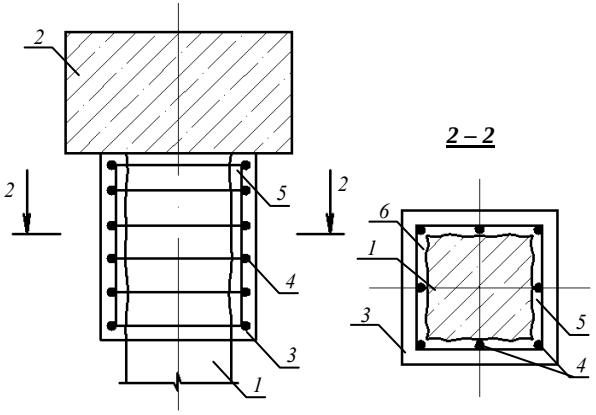
STRENGTHENING OF PILE-TO-GRILLAGE CONNECTIONS

ARRANGEMENT OF REINFORCED CONCRETE JACKET



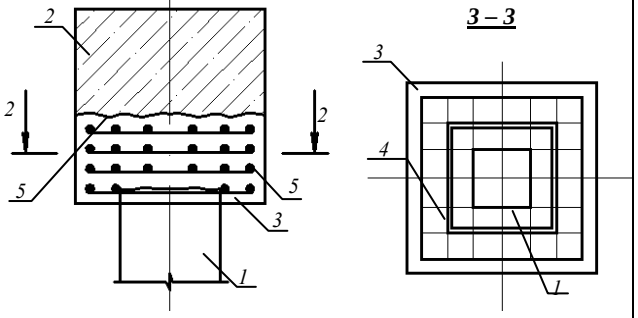
1- reinforced concrete pile displaced from the final position; *2* – reinforced concrete grillage; *3* - strengthening reinforced concrete jacket; *4* - longitudinal reinforcement of jacket; *5* - lateral reinforcement of jacket; *6* - pile surface prepared for concreting the strengthening jacket (cleandowhed and hacked)

ARRANGEMENT OF REINFORCED CONCRETE YOKE



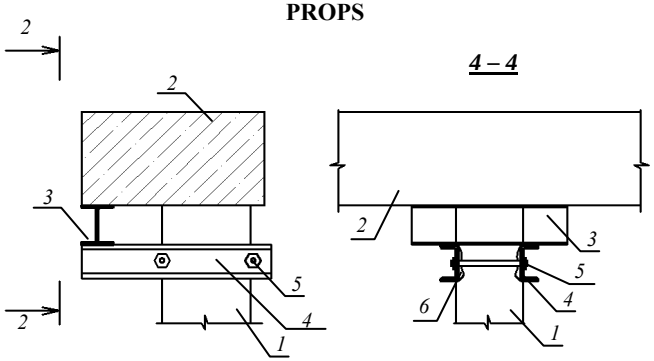
1- reinforced concrete pile with damaged upper part; *2* - reinforced concrete grillage; *3* - strengthening reinforced concrete yoke; *4*- yoke longitudinal reinforcement; *5*- yoke lateral reinforcement; *6* -pile surface prepared for concreting the strengthening yoke (cleandowned and hacked)

ARRANGEMENT OF REINFORCED CONCRETE SPLICE



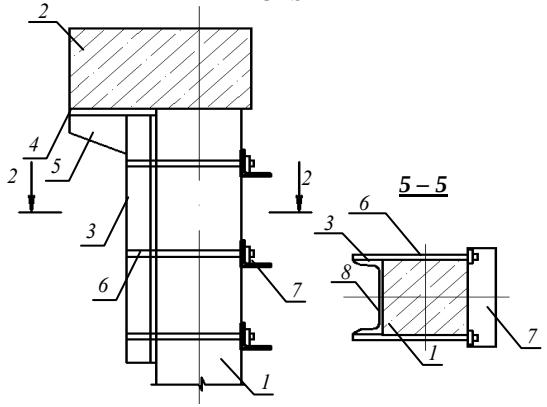
1- reinforced concrete single pile having no contact with grillage; *2* - reinforced concrete grillage; *3* - reinforced concrete splice *at* pile; *4* - later reinforcing fabrics; *5* - pile and grillage surface prepared for concreting (cleandowhed and hacked)

POSITIONING OF ROLLED METAL SUPPORTING PROPS



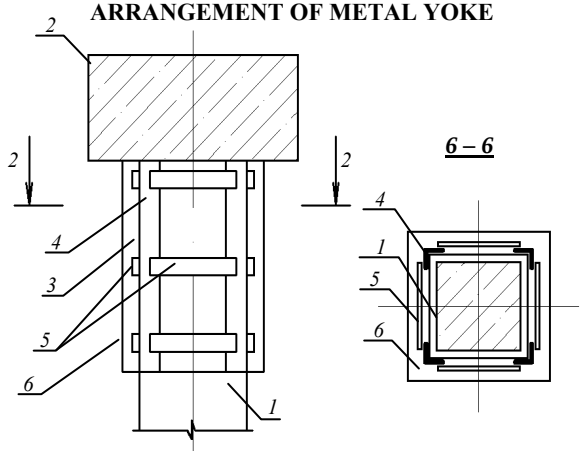
1- reinforced concrete pile displaced from final position; *2*- reinforced concrete grillage; *3*- double-tee supporting prop; *4*- channel prop support placed on mortar in cut out groove; *5*- coupling bolts; *6* - groove cut out in pile concrete cover for fixing the prop supports

POSITIONING OF ROLLED METAL SUPPORTING POST-PROPS



1- reinforced concrete pile displaced from final position; *2* - reinforced concrete grillage; *3* - channel supporting post; *4* - prop supporting sheet; *5* - prop side sheets; *6* - coupling bolts; *7*- anchor-angle washers; *8* - prepared cement-sand contact zone (pile should be hacked; channel is metal springled by welding)

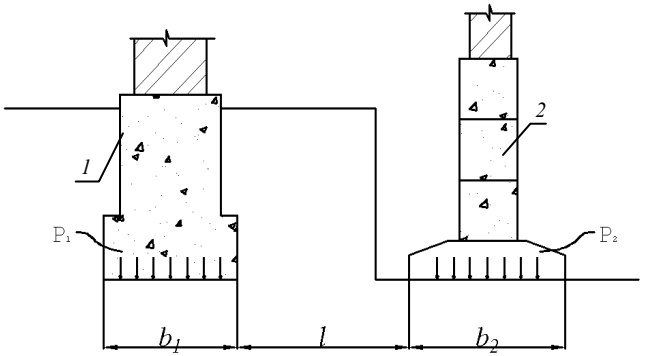
ARRANGEMENT OF METAL YOKE



1- reinforced concrete pile with damaged upper part; *2* –reinforced concrete grillage; *3* - strengthening metal yoke; *4* - yoke longitudinal angles set by means of mortar; *5* - yoke lateral plates welded to angles in heated state; *6* - protective layer of concrete or dense cement-sand plaster

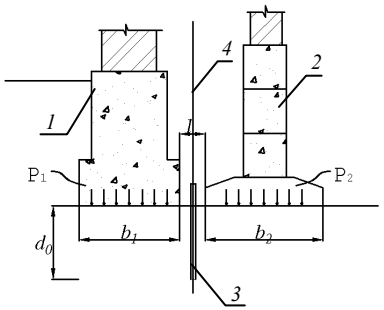
CONSTRUCTION OF FOUNDATIONS VERY CLOSE TO EXISTING BUILDINGS

FOUNDATIONS OF ATTACHED BUILDING WITH THE SAME BASE SINKING DEPTH AS THAT OF EXISTING BUILDING FOUNDATION



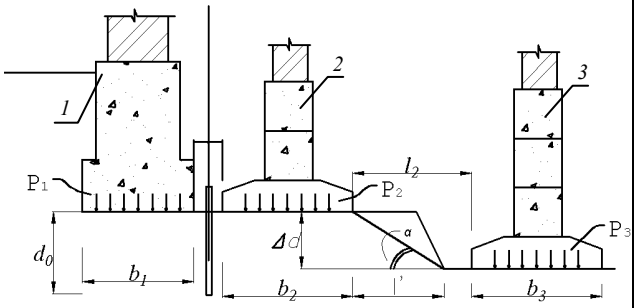
1- existing building foundation; *2*- attached building foundation (strip or pad) l is taken as follows:
when *P/1≈P/2* and *b/1>b/2* then *l≥(2-3)b/1*
when *P/1≈P/2* and *b/2>b/1* then *l≥(2-3)b/2*

FOUNDATIONS OF ATTACHED BUILDING WITH THE SAME BASE SINKING DEPTH AS THAT OF EXISTING BUILDING FOUNDATION



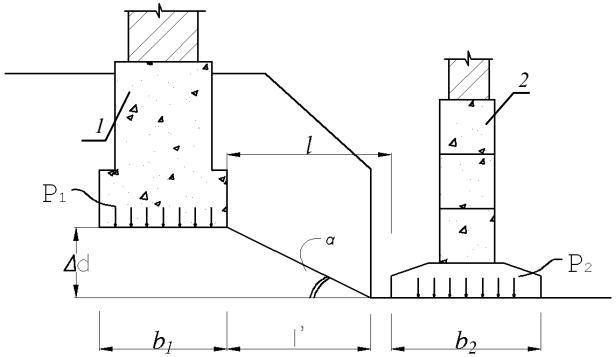
1- existing building foundation; *2*- attached building foundation (strip or pad); *3* - separation enclosing sheeting (sinking depth is taken according design or calculation); *4*- centre line of settlement joint d/0 and l are taken as follows:
when P/1≈P/2 and b/1≈b/2≈b then d/0=2,87*l*+1,64*l*
(according to A.V. Pilyagin and V.E. Glushkov for rigid foundations) *l<b/2*

FOUNDATIONS OF ATTACHED BUILDING WITH THE SAME BASE SINKING DEPTH DIFFERENT FROM THAT OF EXISTING BUILDING FOUNDATION



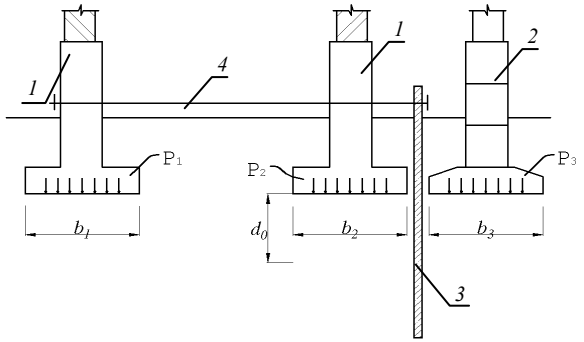
1- existing building foundation; *2*- attached building foundation; *3*- rebate
when P/1≈P/2 and *b/1≈b/2*≈b then d/0=2,87*l/1*+1,64*b*
(according to A.V. Pilyagin and V.E. Glushkov for rigid foundations) *l/1≤b/2*
Assume difference: Δd=l'(tgφ/1+c/1/P/2)

FOUNDATIONS OF ATTACHED BUILDING WITH THE SAME BASE SINKING DEPTH DIFFERENT FROM THAT OF EXISTING BUILDING FOUNDATION



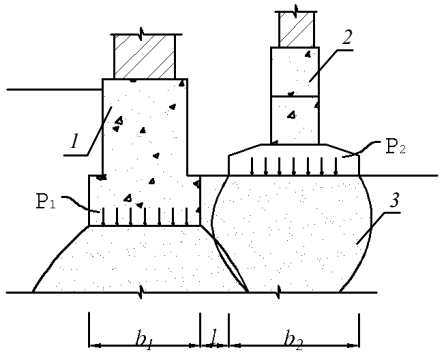
1- existing building foundation; *2* - attached building foundation:
when *b/1≈b/2*≈b then *l≥(2-3)b*
Assume difference: Δ*d=l'(tgφ/1+c/1/P/1)*
φ/1,c/1- design values of internal friction angle and soil unit bond;
P/1- pressure along the base of the above foundation

ADJOINING OF STRIP FOUNDATIONS TO EXISTING BUILDING



1 - foundations of existing building; *2* - foundation of attached building; *3* - separate enclosing sheeting; *4* - anchor
When P/2≈P/3 and b/2≈b/3≈b, d/0 value can be determined according to A.V. Pilyagin and V.E. Glushkov:
d/0=2,37l+1,9b - for flexible foundations
d/0=2,87l+1,64b -for rigid foundations

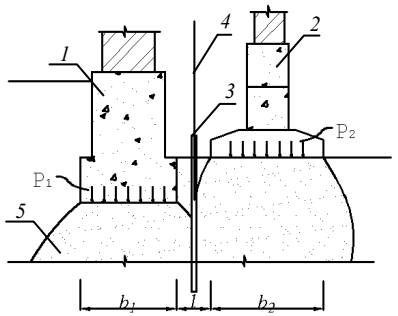
FOUNDATIONS OF ATTACHED BUILDING WITH THE SAME BASE SINKING DEPTH DIFFERENT FROM THAT OF EXISTING BUILDING FOUNDATION



1 - existing building foundation; *2* - attached building foundation; *3* - areas of foundation bed pressed thickness *l* value is taken as follows:
when *P/1>>P/2* and *b/1≥b/2* then *l≥b/1*
when *P/1≤P/2* and *b/1≈b/2*≈b then *l≥b*

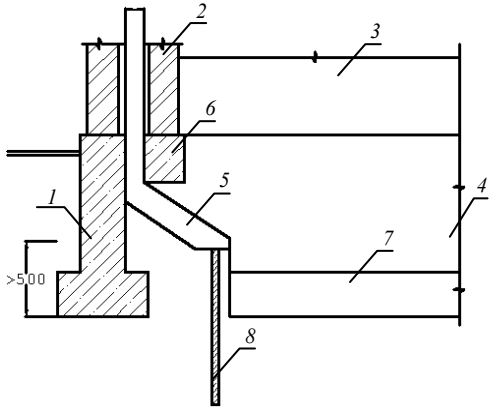
LAYING OF NEW FOUNDATIONS CLOSE TO EXISTING BUILDINGS

FOUNDATIONS OF ATTACHED BUILDING WITH THE SAME BASE SINKING DEPTH DIFFERENT FROM THAT OF EXISTING BUILDING FOUNDATION



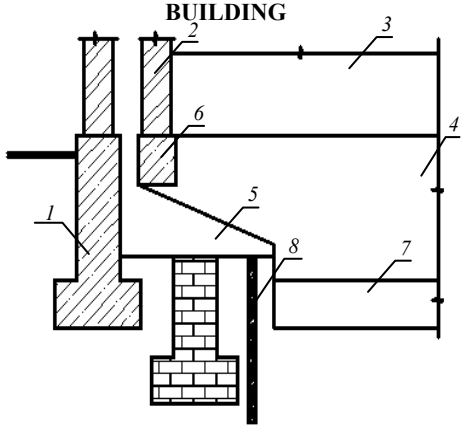
1- existing building foundation; *2* - attached building foundation (strip or cast-in-place); *3* - separation enclosing sheeting (sinking depth is taken according design or calculation); *4*-centre line of settlement joint d/0 and l are taken as follows:
when *b/1<b/2* then *l≤b/1*
when *b/2*<b/*1* then *l≤b/2/2.* d/0*=(2-2.5)b/2*

ADJOINING OF LONGITUDINAL BEARING WALL STRIP FOUNDATIONS TO EXISTING BUILDING



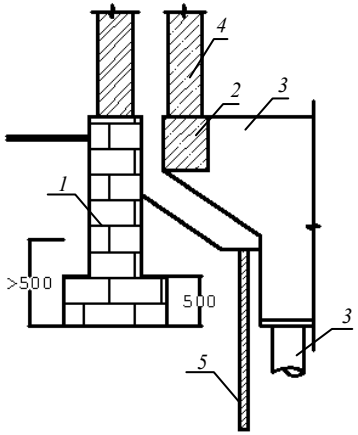
1- existing foundation; *2* - enclosure wall; *3* - longitudinal bearing wall; *4* - foundation wall portion with cast-in-place reinforced concrete cantilever; *5* - clearance; *6* - cast- in-place reinforced concrete beam;*7* - foundation plate portion; *8*- rebate

ADJOINING OF STRIP FOUNDATIONS TO EXISTING BUILDING



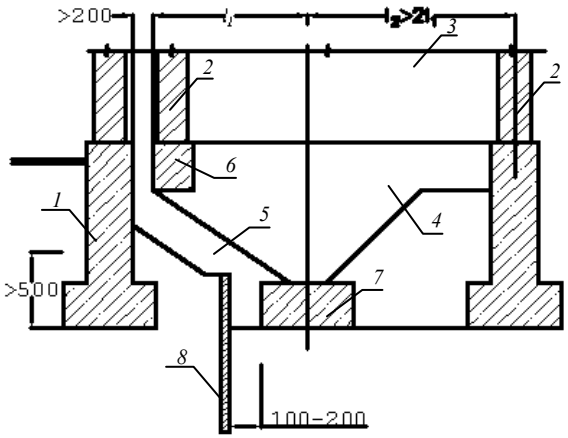
1 - existing foundation; *2* –enclosure cross wall; *3* - longitudinal bearing wall; *4* - foundation wall portion with cantilever; *5* - re-mained part of old building; *6* - cast-in-place reinforced concrete beam; *7*- foundation plate portion; *8* - rebate

ADJOINING OF PILED FOUNDATIONS CLOSE TO EXISTING BUILDING



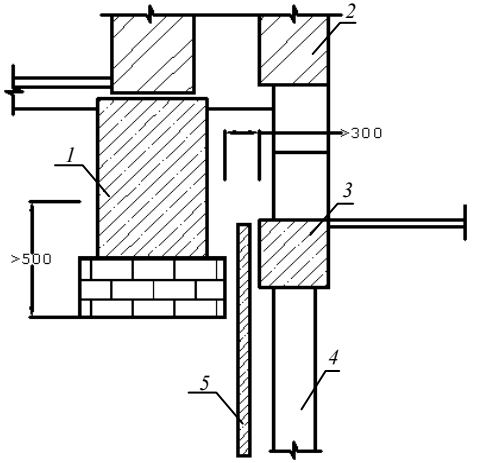
1-existing foundation; *2*- cast-in-place reinforced concrete grillage with the cantilever of attached building; *3*- bored piles; *4* - bearing enclosure wall; *5*- technological (lost) rebats;

ADJOINING OF CROSS BEARING WALL STRIP FOUNDATIONS TO EXISTING BUILDING



1- existing foundation; *2* - bearing walls; *3*- longitudinal non-bearing wall; *4*- cantilevered portion of longitudinal foundation wall; *5*-clearance; *6* - cast-in-place reinforced concrete beam; *7*- la-teral strip foundation; *8* - rebate

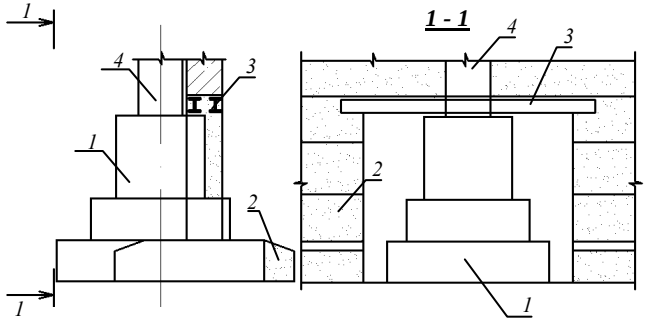
ADJOINING OF PILED FOUNDATIONS CLOSE TO EXISTING BUILDING



1- existing foundation; *2*- enclosure wall of attached building; *3*- cast-in-place reinforced concrete grillage of attached building; *4* - pile; *5*- technological (lost) enclosing sheeting

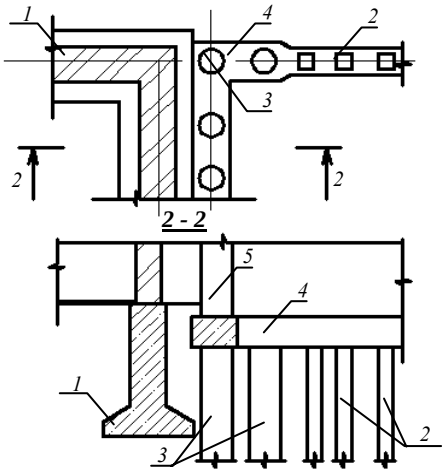
LAYING OF FOUNDATIONS CLOSE TO EXISTING BUILDINGS

ADJOINING OF STRIP FOUNDATIONS TO EXISTING BUILDING



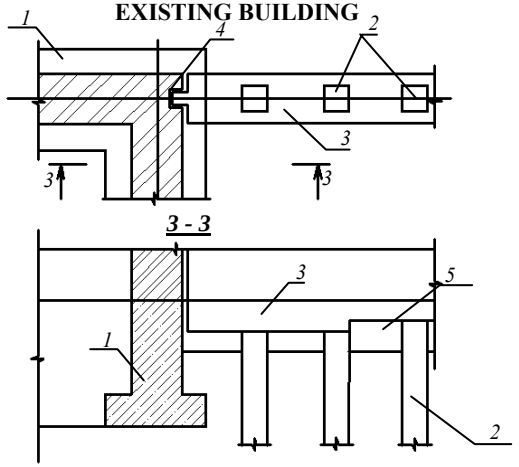
1 - existing pad foundation; *2* - strip foundation of attached building; *3* - metal beams spanning the strip foundation opening; *4* - column

ADJOINING OF PILED FOUNDATIONS CLOSE TO EXISTING BUILDING



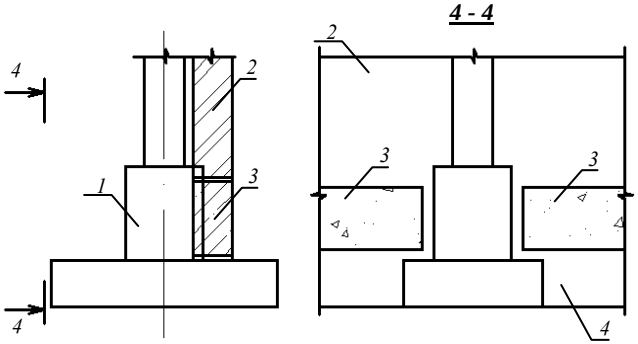
1- existing foundation; *2* - driven piles*; 3* - bored piles; *4* - expanded portion of grillage; *5* - enclosure wall structure

ADJOINING OF PILED FOUNDATIONS CLOSE TO EXISTING BUILDING



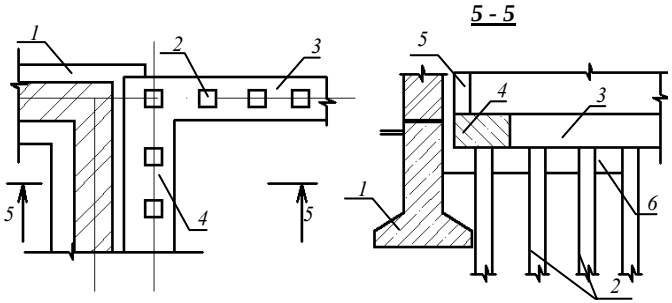
1- existing foundation; *2*- driven piles; *3* - cast-in-place reinforced concrete grillage with the cantilever of attached building; *4* - joggle in brick wall of existing building; *5* - air clearance

ADJOINING OF ATTACHED BUILDING WALL TO EXISTING BUILDING



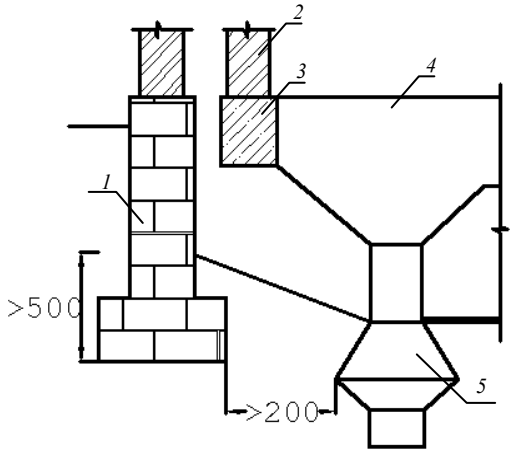
1- existing pad foundation; *2*- brick wall of attached building; *3*- reinforced concrete beams (cast-in-place or precast); *4*- air clearance

ADJOINING OF PILED FOUNDATIONS CLOSE TO EXISTING BUILDING



1 - existing foundation; *2* - driven piles; *3*- grillage; *4* - cantilevered portion of grillage; *5* - enclosure wall structure; *6* - air clearance

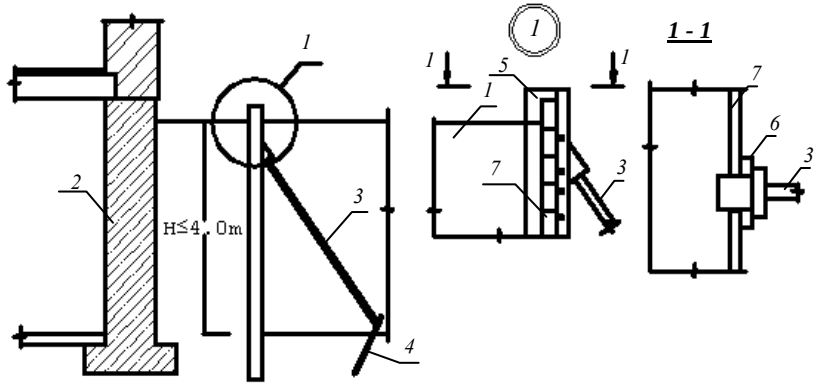
ADJOINING OF PILED FOUNDATIONS CLOSE TO EXISTING BUILDING



1- existing foundation*; 2* - enclosure wall; *3* - cast-in-place reinforced concrete beams; *4* - cantilevered portion of foundation wall; *5* - bored pile with extended base

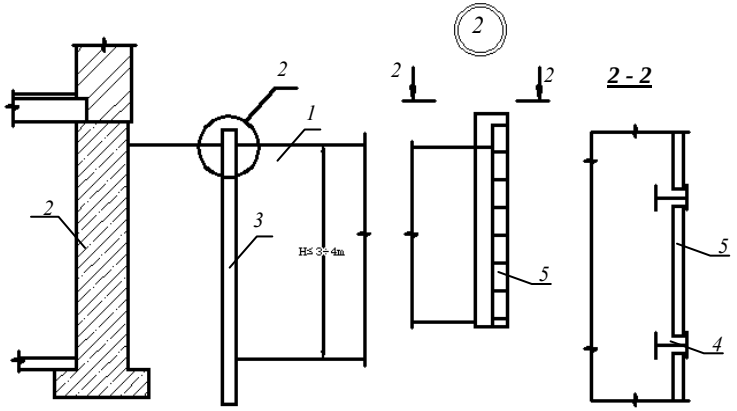
SHORING OF EXCAVATION WALLS IN CASE OF BUILDING OPERATIONS NEAR EXISTING STRUCTURES

BACK PROP SHORING OF TRENCH AND PIT VERTICAL WALLS



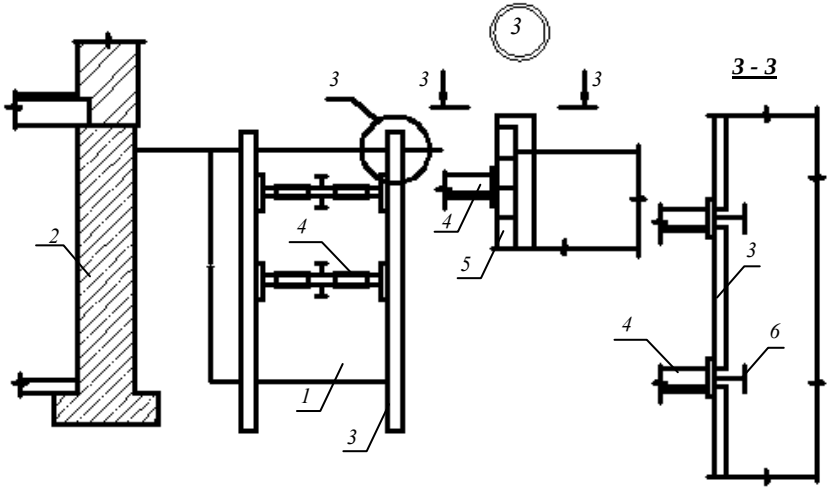
1- trench out near the existing building; *2* - foundation of the functioning building; *3* - wooden back prop; *4* - anchor; *5*- 150x150 mm square-sawn timber posts; *6* - 50x50 mm square-sawn timber planks; *7* - 50 to 60mm thick boards

SHORING OF EXCAVATION WALLS IN CASE OF BUILDING OPERATION NEAR THE EXISTING STRUCTURES



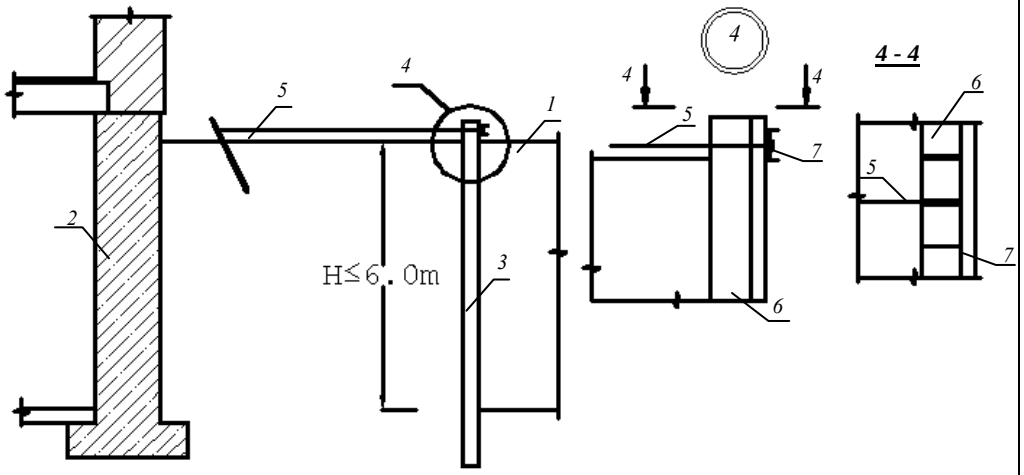
1- cantilever shoring of trench and pit vertical walls; *2*- excavation near the existing building (trench or pit); *3* - cantilever -rebate-metal-wooden shoring system (of driven or cast-in-place reinforced concrete piles, wood, metal standard rebate); *4* - double tee section metal posts; *5* - 50 to 60 mm thick boards

CANTILEVER-THRUST SHORING OF TRENCH VERTICAL BALLS



1- trench cut near the existing building; *2* - foundation of the functioning building; *3*- cantile-ver-thrust shoring of walls of metal posts and boards (can be done by means of wooden or metal sheets; *4* - screw diagonals; *5* - 50 to 60 mm thick boards; *6* - double-tee section metal posts

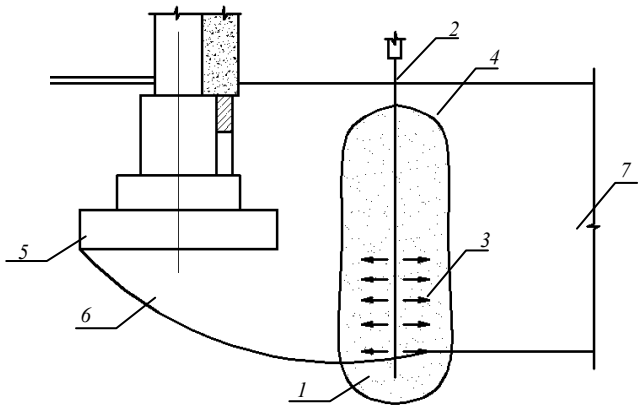
ANCHOR SHORING OF TRENCH AND PIT VERTICAL WALLS



1- trench cut near the existing building; *2* - foundation of the functioning building; *3* - anchor shoring of walls of reinforced concrete driven piles (can be done by means of metal standard rebate, cast-in-place piles and other members); *4* - anchor; *5* - metal tie; *6* - driven square-sawn timber piles, *7* - metal channel beam

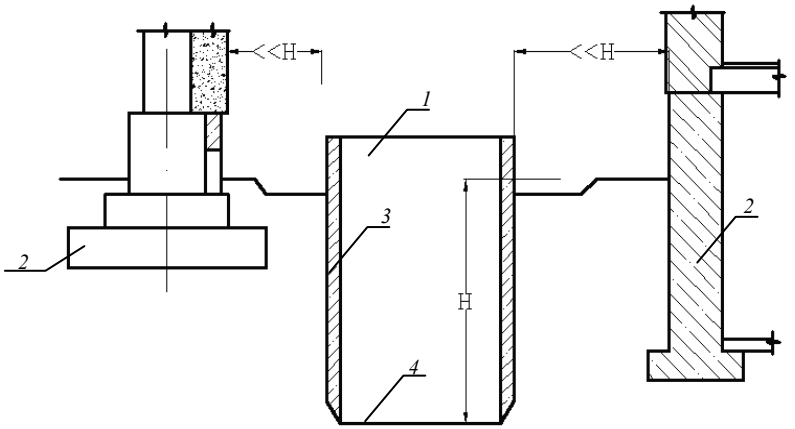
SHORING OF EXCAVATION WALLS IN CASE OF BUILDING OPERATIONS NEAR THE EXISTING STRUCTURES

STABILIZATION OF SOIL FOR ARRANGEMENT OF TRENC AND PIT VERTICAL WALLS



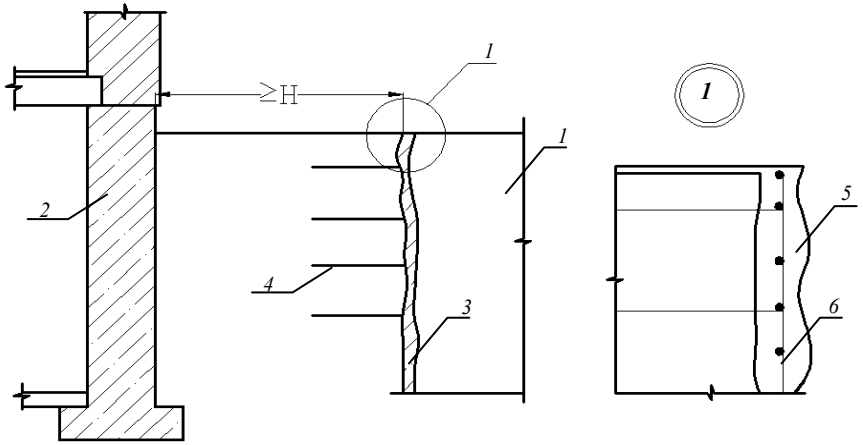
1- area of stabilized soil (by means of silicatization, cementation, alkalization and other physico-chemical methods); *2*- injectors for pressure feeding the hardening solution into soil; *3*- direction of hardening solution distribution; *4* - excavation near the underground structures of existing building (trench or pit) made after soil stabilization; *5* - foundation of the functioning building; *6* - surface potentially subjected to loss of bed stability; *7* - excavation bottom mark

SHORING OF EXCAVATION VERTICAL WALLS BY GUNITING



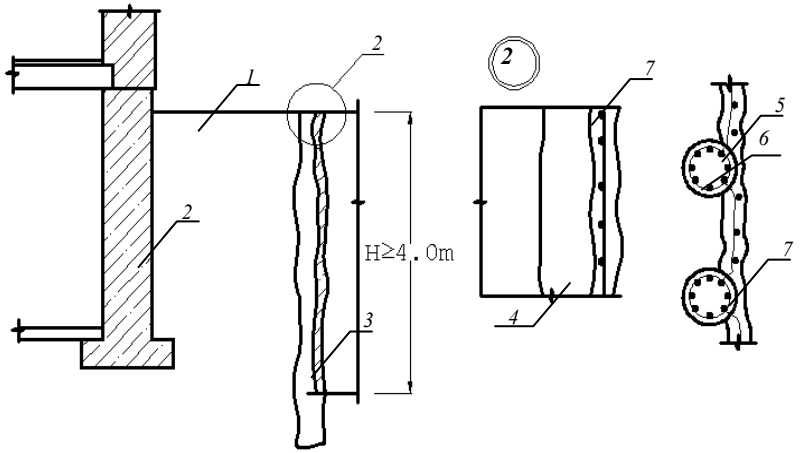
1- pit made in narrow space; *2* - foundations of functioning buildings; *3* - caisson; *4* - excavated soil surface

ARRANGEMENT OF PIT VERTICAL WALLS BY MEANS OF CAISSON



1 - excavation near the existing building (trench or pit); *2* - foundation of the functioning building; *3* - gunite vertical wall (spraying of concrete under pressure); *4* - reinforcing steel rods (soil nails); *5* - concrete surface; *6* - metal mesh with 150x150 mm cells welded to reinforcing steel rods

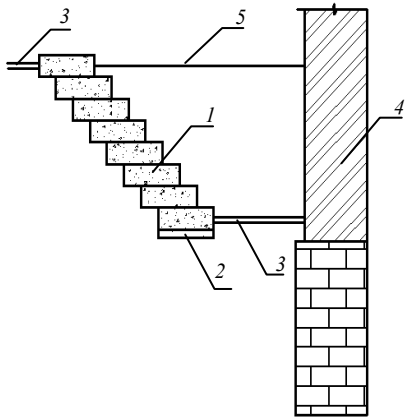
COMPOSITE SHORING OF PIT AND TRENCH VERTICAL WALLS



1 - excavation near the existing building (trench or pit); *2* - foundation of the functioning building; *3* - excavation composite wall made of bored pile and gunite; *4* - bored piles; *5* - gunite surface; *6* - bored pile *reinforcement*; *7* - metal mesh with 150x150 mm cells welded to bored pile reinforcement (during excavation work pile reinforcement is exposed)

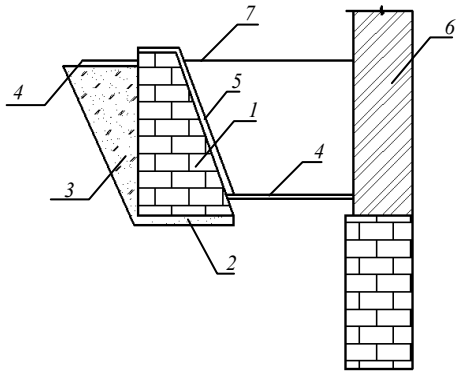
SLOPE PROTECTION BY MEANS OF RETAINING WALLS IN CASE OF DEPRESSED GRADING SURFACE IN WALLS OF LONG OPERATING BUILDINGS

ERECTION OF BLOCK RETAINING WALL



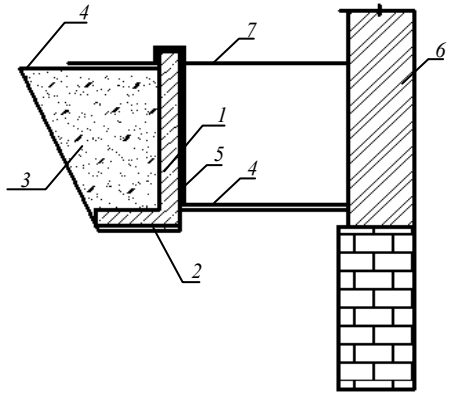
1 - precast concrete (reinforced concrete) blocks retaining wall; *2* - compacted gravel-sand mix bed; *3* - hard cover; *4* - wall of the long operating building; *5* - slope grading surface prior to its depression

ERECTION OF SOLID (GRAVITATION) RETAINING WALL



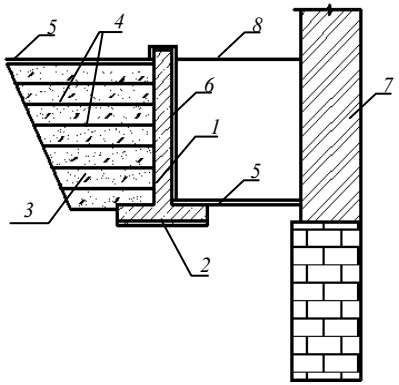
1 - retaining wall made of cement-sand mortar rubble masonry (or cast-in-place concrete); *2* - compacted gravel-sand mix bed; *3* - local soil backfill; *4* - hard cover; *5* - finishing coat; *6* - wall of the long operating building; *7* - slope grading surface prior to its depression

ERECTION OF CANTILIVER RETAINING WALL



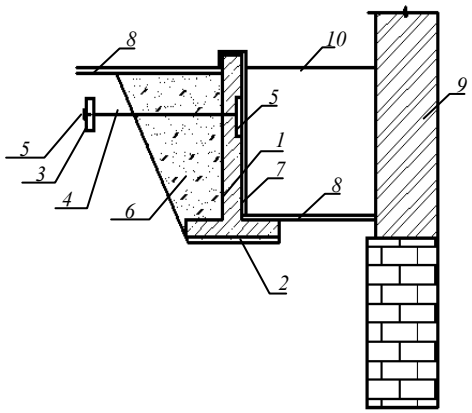
1 - reinforced concrete; *2* - compacted gravel-sand mix (or lean concrete) bed; *3* - local soil backfill; *4* - hard cover; *5* - finishing coat; *6* - wall of the long operating building; *7*- slope grading surface prior to its depression

ERECTION OF RETAINING WALL WITH RELIEVING ELEMENTS



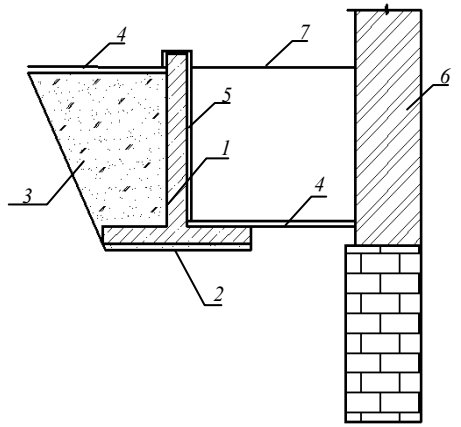
1 - reinforced concrete retaining wall; *2* - compacted gravel-sand mix (or lean concrete) bed; *3* - local soil backfill; *4* - relieving elements reinforcing the fill (layers of geotextile - a strong synthetic material); *5* - anchor reinforced concrete uplift slabs ; *6* - finishing coat; *7*- wall of long operating building; *8* - slope grading surface prior to its depression

ERECTION OF ANCHOR RETAINING WALL



1 - reinforced concrete; *2* - compacted gravel-sand mix (or lean concrete) bed; *3* - anchor reinforced concrete uplift slabs ; *4* - anchor steel tie-rods; *5* - metal plates; *6* - local soil backfill; *7* - finishing cover; *8* - hard cover; *9* - wall of long operating building; *10* - slope grading surface prior to its depression

ERECTION OF CANTILIVER RETAINING WALL



1 - reinforced concrete; *2* - compacted gravel-sand mix (or lean concrete) bed; *3* - local soil backfill; *4* - hard cover; *5* - finishing coat; *6* - wall of long operating building; *7* - slope grading surface prior to its depression

PILE DRIVING CLOSE TO FUNCTIONING BUILDINGS

Safe distances between the driven pile and the functioning buildings that do not cause deformation, or damage in members and units of the buildings

BED SOILS	Safe distances (in metres) with the account of type of building and the pile section or diameter (in centimeter)								
	Brick and block buildings with various depth of foundation bed sinking			Brick, reinforced concrete framed and panel buildings			Framed steel and cast-in-place concrete buildings		
	30x30	40x40	Ø50	30x30	40x40	Ø50	30x30	40x40	Ø50
CLAYS AND LOAMS									
hard and semihard	18	18	20	12	12	14	7	9	11
tight plastic	10	11	13	6	7	8	4	5	6
soft plastic	6	7	8	3	3	4	2	2	3
fluid plastic	3	3,5	4	3	3	4	2	2	3
SANDS									
coarse-grained and medium- grained	3	3	4	2	2	3	2	2	3
fine-grained dense	3	3	3	2	2	3	2	2	3
dust sand	13	14	16	13	14	16	6	6	8
PLASTIC AND LOAM	10	11	12	10	11	12	5	5	7

Notes: For types of buildings not indicated in the Table and for piles of other sections (diameters) as well as in cases when there are vibration sensitive instruments and devices in the buildings, safe distances are determined with the account of technical state of building members and units and the results of observing their deformation in driving the piles.

SAFETY MEASURES TO BE TAKEN INTO ACCOUNT IN PILE DRIVING NEAR THE FUNCTION BUILDINGS

1.Before starting pile driving close to functioning buildings (with distances shorter than those listed in the Table) it is recommend to examine the technical state of members and units of the building (including foundations), determine the loads acting on them, study the maintenance conditions of the building, engineering geological conditions of building site and summerize the experience of construction work in the given area. In case of unsatisfactory condition of main building members and units it is necessary to do work on their strengthening, repair and restoration.

2.When the distance is less than safe, constant observation of the technical state of building members and units should be made. For this purpose furrings, settlement markers, levels, theodolites and other devices and instruments are used. In cases when deformations in members and units exceed the allowable values (cracks, displacements, spellings, foundation settlements and others) pile driving should be stopped and measures should be taken to eliminate failures.

3.Settlement markers and furrings are usually placed on a part of the functioning building which is the nearest to pile driving (external walls, foundations, columns, etc.). Observation of building members state is made after each pile loading.

To decrease the dynamic influence on the functioning building members and units, caused by pile driving, the following measures can be taken:

- decrease in driven pile cross section and length;

- decrease in fall height of pile driving hammer striker;

- arrangement of enclosure sheeting, trench or pit in the area between the driven piles mid the functioning building;

- sinking and driving of piles through leading bores (this is of special effect in packed and heterogeneous soils);

- sinking and driving of piles with washing away of sandy soils;

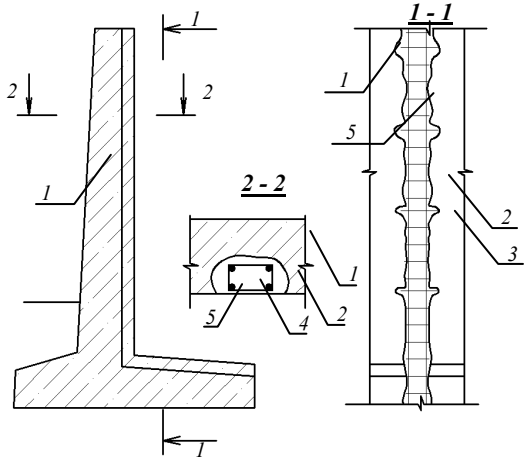
- use of electroosmose method in driving the piles in dust-clay soils;

- sinking (driving) of piles in thixotrop jacket;

- use of other methods of sinking, and driving the piles (jacking, driving by vibration, bored and bore injected piles)

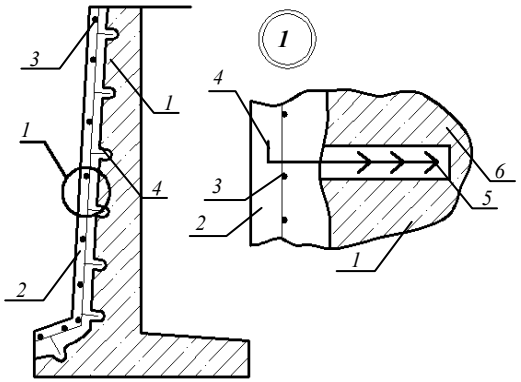
STRENGTHENING OF RETAINING WALLS

ARRANGEMENT OF REINFORCED CONCRETE CORES



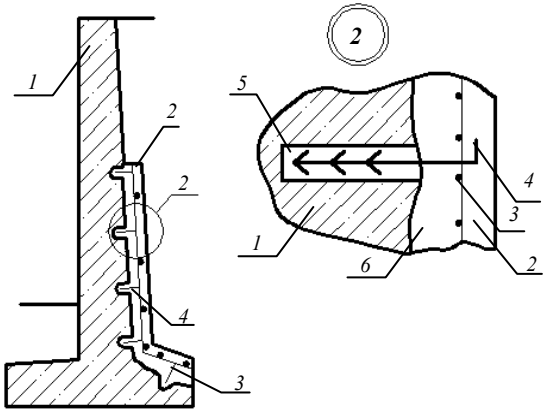
1 - concrete or reinforced concrete retaining wall; *2* - toothing in the wall spaced at 1,5 to 2.0 m; *3*- expansion in toothing for key formation; *4* - reinforced concrete core; *5* - reinforcing cage

ARRANGEMENT OF REINFORCED CONCRETE SPLICE IN COMPRESSED ZONE



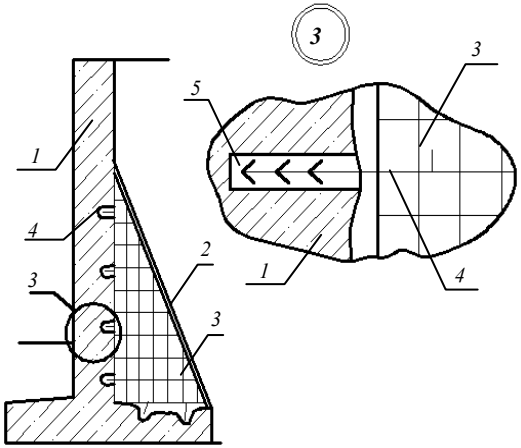
1 - concrete or reinforced concrete retaining wall; *2* - reinforced concrete splice in comp- ressed zone; *3* - rein- forcing fabric tied to anchors; *4* - 10 to 14 mm diameter reinforcing periodic profile steel anchors (to be fixed on cement-sand mortar); *5* - 12 to 16 mm diameter holes drilled to the depth of 100 to 150 mm; *6*- retaining wall surface prepared for concreting

ARRANGEMENT OF REINFORCED CONCRETE SPLICE IN STRETCHED ZONE



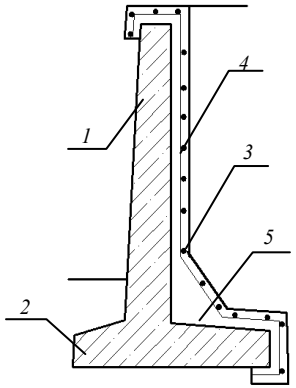
1 - concrete or reinforced concrete retaining wall; *2* - reinforced concrete splice in stretched zone; *3* - fabrics principle reinforce- ment; *4* - periodic profile reinforcement anchors set on mortar; *5* - holes drilled in retaining wall; *6* - wall surface prepared for concreting

ARRANGEMENT OF COUNTERFORTS



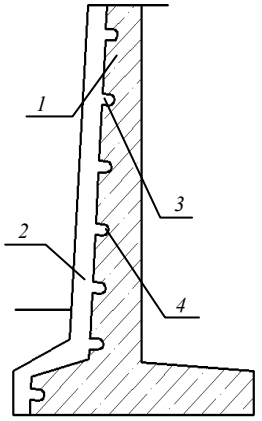
1- reinforced concrete retaining wall; *2* - reinforced concrete counterforts; *3*- reinforcing cage; *4*- periodical profile reinforce- ment anchors; *5* - hole in the wall (to be caulked by mortar after fixing the anchor)

ARRANGEMENT OF REINFORCED CONCRETE SPLICE IN CASE OF SIMMULTANEOUS WALL AND BEARING SLAB STRENGTHENING



1 - concrete or reinforced concrete retaining wall; *2* - wall bearing slab; *3* - reinforced concrete splice in stretched zone; *4* - reinforcing fabric; *5* - wall surface prepared for concreting (cleandowned and hacked)

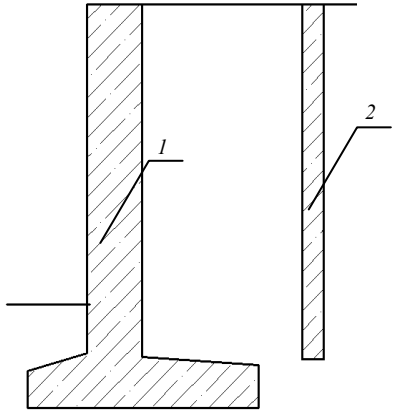
ARRANGEMENT OF CONCRETE SPLICE IN COMPRESSED ZONE



1 - concrete or reinforced concrete retaining wall; *2* - concrete splice in compressed zone; *3* - recesses made is retaining wall; *4* - retaining wall surface prepared for concreting (cleandowned and hacked)

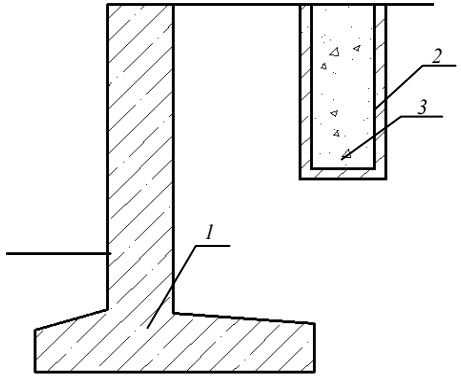
STRENGTHENING OF RETAINING WALLS

ARRANGEMENT OF PROTECTIVE SHEETING



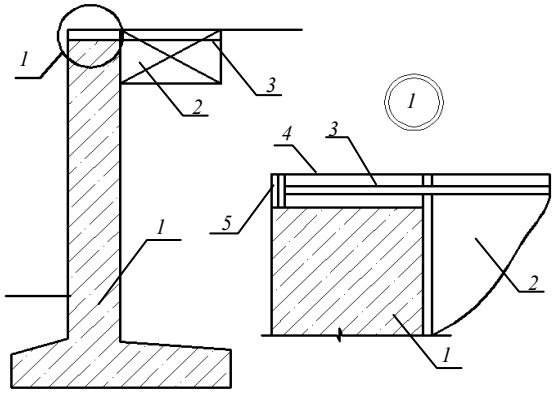
1 - reinforced concrete retaining wall; *2* - protective sheeting

ARRANGEMENT OF BALANCING TRENCH



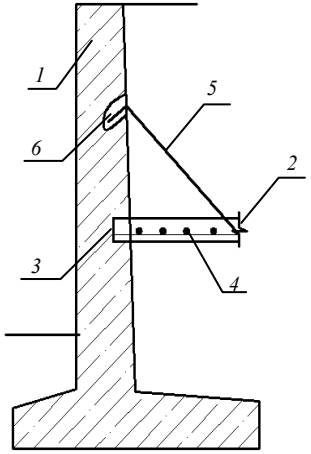
1 - reinforced concrete relieving wall; *2* - balancing trench filled with soil; *3* - ash or slag filling

PLACING OF RELIEVING BLOCKS



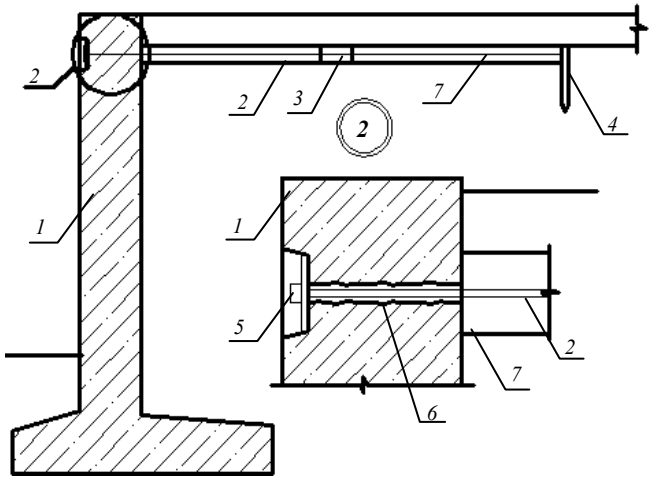
1 - reinforced concrete retaining post; *2* - relieving concrete blocks; *3* - anchor tie; *4* - groove cut out in the wall (to be filled with concrete after fixing the ties); *5* - supporting plate-washer

ARRANGEMENT OF RELIEVING PLATFORMS



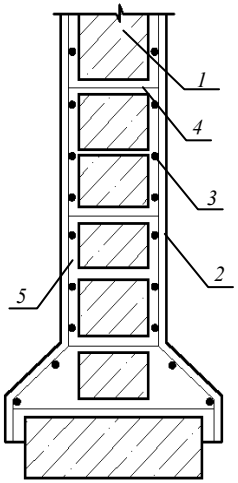
1- reinforced concrete retaining wall; *2* - relieving platform; *3* - recess in the wall (without cutting out the reinforcement); *4* - reinforcing fabric (to be bent into recesses); *5* - reinforcing steel suspenders protected from corrosion; *6* - anchors set on the cement-sand mortar into drilled holes

ARRANGEMENT OF STAY RODS



1 - reinforced concrete retaining wall; *2* - reinforcing steel stay rod; *3* - turnbuckle; *4* - anchor pile; *5* - supporting plate washer; *6* - hole in the wall (to be filled with mortar after fixing the stay rod); *7* - stay rod concreted after its tensioning

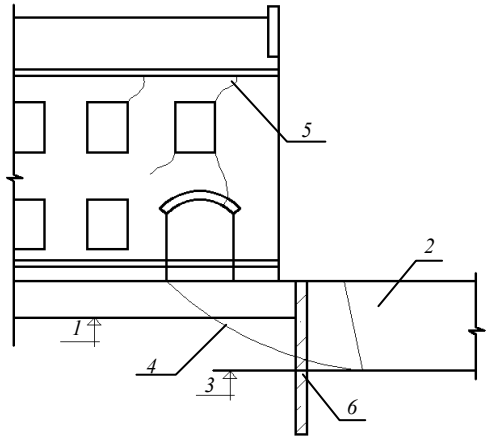
ARRANGEMENT OF REINFORCED CONCRETE YOKE



1 - concrete block retaining wall; *2* - reinforced concrete yoke; *3* - reinforcing fabrics tied to anchors; *4* - anchors set in joints between blocks; *5* - block surfaces prepared for concreting

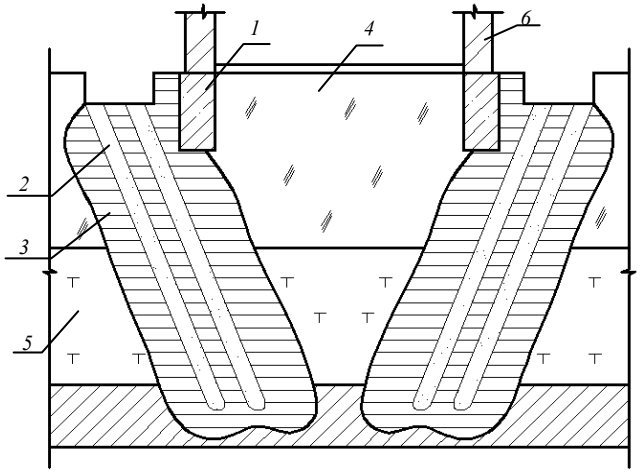
STRENGTHENING OF FOUNDATION BEDS

ARRANGEMENT OF SHEETING FOR PREVENTION OF FOUNDATION STABILITY LOSS



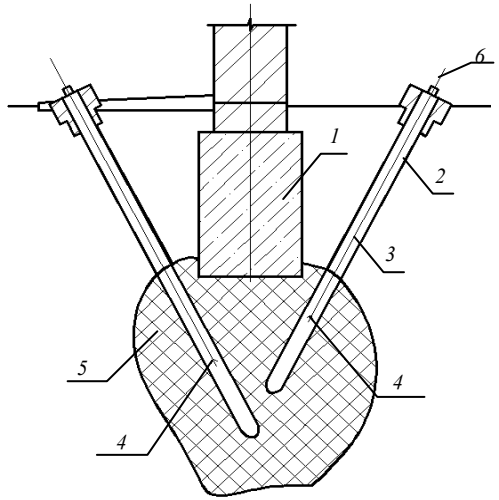
1 - foundation foot mark; *2* - foundation trench close to the building; *3* - foundation trench bottom mark; *4* - slip surface in case of foundation stability loss; *5* - cracks in building walls; *6* - sheeting

ARRANGEMENT OF SAND PILES FOR DEEP BED COMPACTION



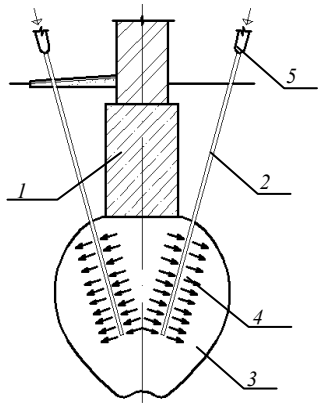
1 - existing foundations; *2* - sand piles; *3* - compaction zones; *4* - filling soil; *5* - turf; *6* - brick walls

THERMAL STABILISATION OF SOIL



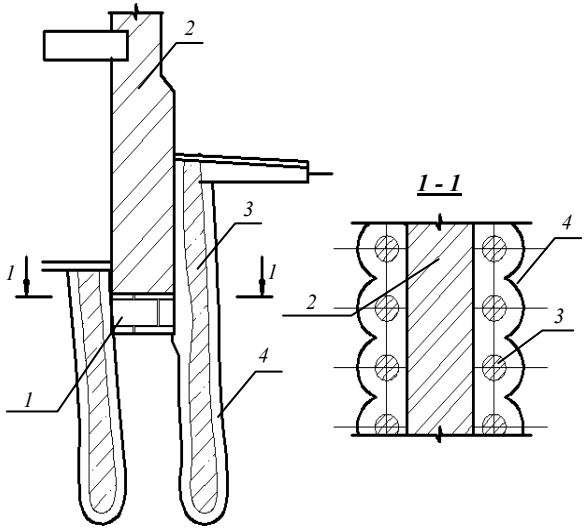
1 - existing foundation; *2* - holes; *3* - tipped nozzle; *4* - flame; 5 - stabilised soil; *6* - fuel distributing tube

WAYS OF SOIL CHEMICAL STABILIZATION BY INJECTING MORTAR INTO FOUNDATION BED (CEMENTING, BITUMINOUS GROUTING, SILICAIIZATION, TARRING AND OTHERS)



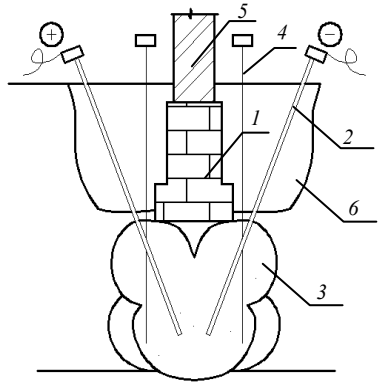
1 - existing foundation; *2*- injectors sunk from bed surface; *3*- stabilised soil; *4*- direction of stabilizing mortar spreading

ARRANGEMENT OF DENSILY SPACED BORED PILES



1 - existing foundation; *2* - brick wall; *3* - bored piles; *4* - soil compaction zone

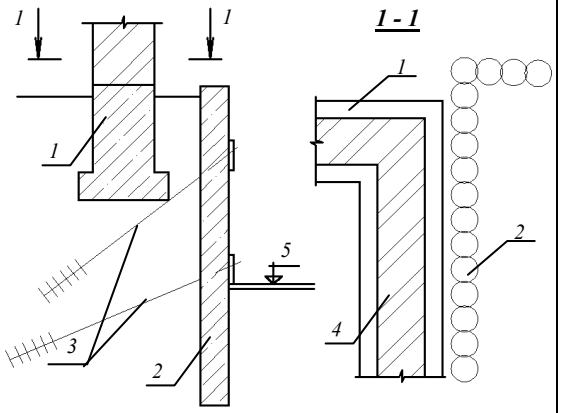
ELECTROCHEMICAL STABILIZATION OF WATERSATURATED, CLAY, SILTY SOILS (ELECTROSILICATIZATION, ELECTROLYTE TREATMENT, ELECTROOSMOSIS COMPACTION)



1 - existing foundation; *2* - injector-electrodes (or rods of electrode) sank from surface; *3* - stabilized soil mass; *4* - other position of injector-electrodes (or rods of electrode; *5* - brick wall; *6* - broken up pit cavity of foundation

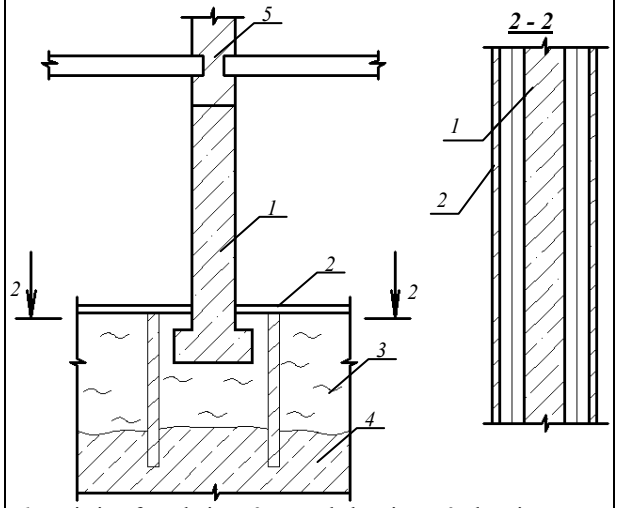
STRENGTHENING OF FOUNDATION BEDS

ARRANGEMENT OF SECANT WELLS BY "WALL IN SOIL" METHOD FOR INCREASING THE FOUNDATION BED BEARING CAPACITY



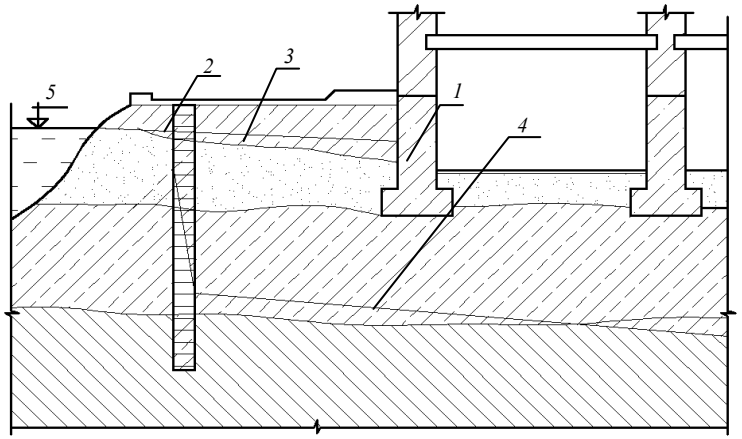
1 - existing foundation; *2* - secant wells arranged by “wall in soil" method; *3* - inclined anchors; *4* - brick wall; *5* - foundation trench bottom mark

ARRANGEMENT OF SHEETINGS FOR INCREASING THE FOUNDATION BED BEARING CAPACITY



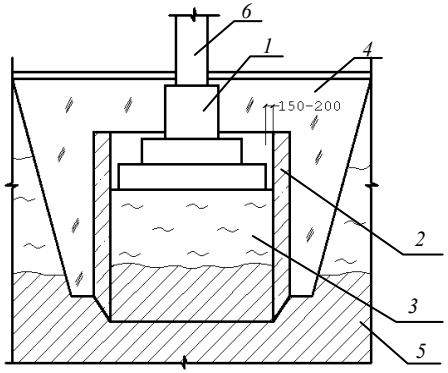
1 - existing foundation; *2* - metal sheetings; *3* - bearing course (soft soil); *4* - base course (firm soil); *5* - brick wall

ARRANGEMENT OF GROUT CURTAINS FOR FOUNDATION BED PROTECTION FROM SUBMERGENCE AND FOR INCREASING THE BED STRENGTH



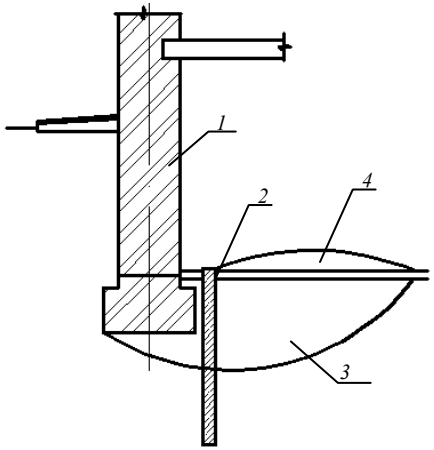
1 - existing foundation; *2* - trench-type grout curtain arranged by "wall in soil" method and filled with clay-cement mix; *3, 4* - depression curve before and after grout curtain arrangement respectively; *5* - water level in basin

STRENGTHENING OF PAD FOUNDATION BY DREDGING WELL ERECTION



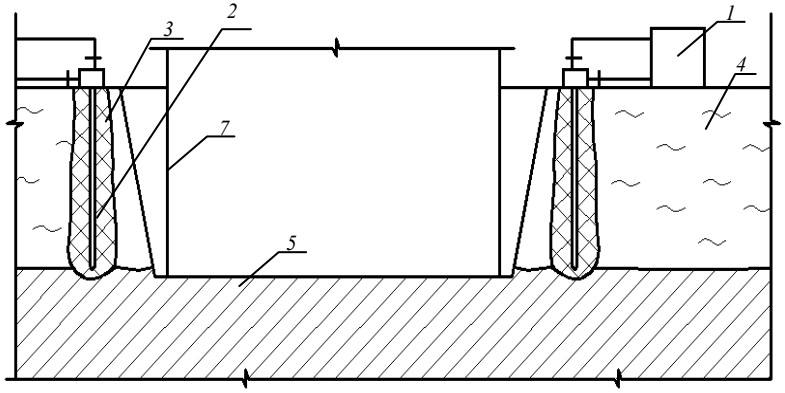
1 - foundation under strengthening; *2* - dredging well with sharpened outer part of blade; *3* - pressed bed (soft soli); *4* - gravel-sand mix or other material filling along external perimeter of dredging well sails; *5* - firm soil; *6* - column

ARRANGEMENT OF SHEETING FOR SOIL BULGING PREVENTION



1 - existing foundation; *2* - steel sheeting; *3* - slip surface in soil bulging out of foundation foot; *4* - basement floor

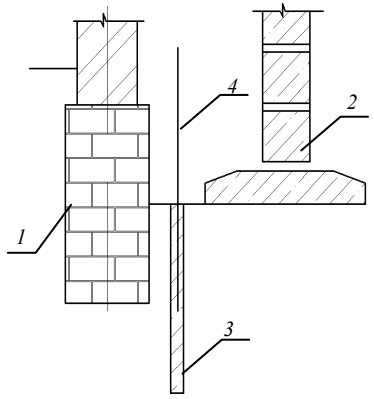
FREEZING OF SATURATED CLAY SOIL (FORMATION OF ICESOIL WALLS)



1 - freezing installation; *2* - hermetic freezing columns; *3* - frozen soil watertight icesoil walls; *4* - saturated silty; *5* - clay soil acting as confining bed; *6* - excavated pit; *7* - erected building contours

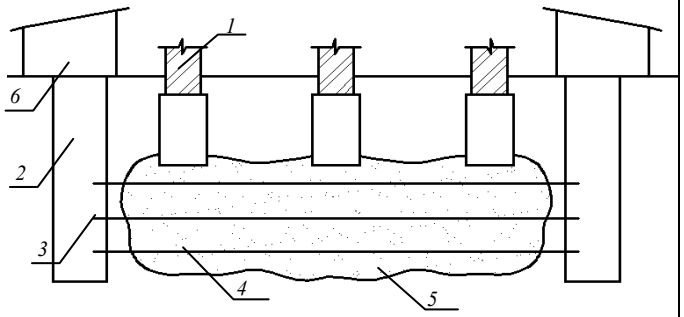
STRENGTHENING OF FOUNDATION BEDS

ARRANGEMENT OF SHEETING FOR PREVENTION OF IRREGULAR FOUNDATION SETTLEMEN



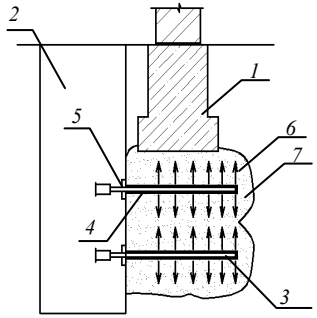
1 - foundation (rubble) of existing building; *2* - precast reinforced concrete foundation of erected building; *3* - separating sheeting; *4* - settlement joint axe

WAYS OF SOIL CHEMICAL STABILIZATION BY INJECTING MORTAR INTO FOUNDATION BED (CEMENTING, BITUMINOUS GROUTING, SILICAIIZATION, TARRING AND OTHERS)



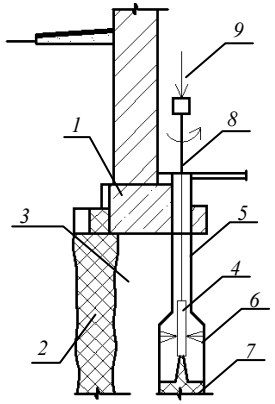
1 - existing foundations; *2* - technological pits; *3* - injectors sunk from pits horizontally; *4* - directions of injectors sinking; *5* - stabilised soil; *6* - facilities for technological equipment

STRENGTHENING OF DUST CLAY SOIL FOUNDATION BY HIGH-HEAD INJECTION OF CEMENT, SILTY-CEMENT, CEMENT-SAND MORTAR



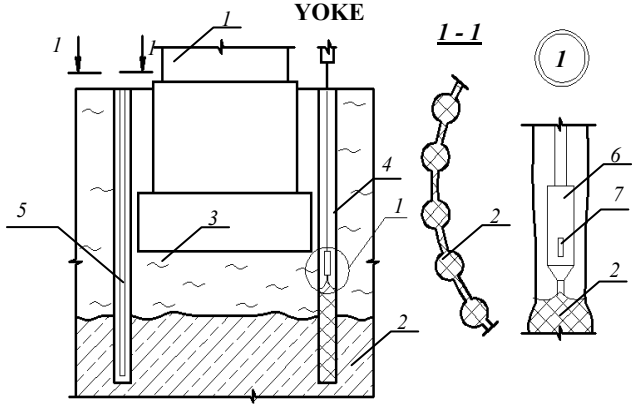
1 - existing foundation; *2* - vertical shaft; *3* - horizontal wells; *4* - injector for cement, silty-cement or cement-sand mortar feed under high pressure (up to 10MPa); *5* - collars to maintain high pressure; *6* - direction of stabilized mortar flow; *7* - contours of stabilized soil

STRENGTHENING OF FOUNDATION BED BY MEANS OF HYDROJET TECHNIQUE WITH FORMATION OF CEMENT-SOIL PILES



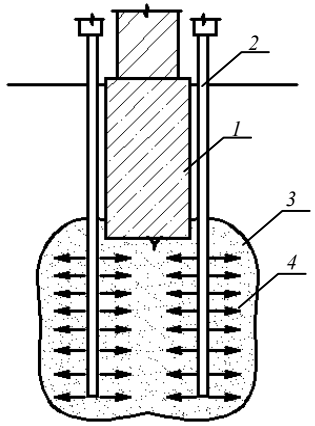
1 - existing foundation; *2* - cement-soil piles spaced at 0,5 to 1.2m and less; *3* - silty, peat, dust, clay soil bed to be strengthened; *4* - jet monitor for feeding highhead water jet and cement mortar; *5* - lead-ing bore hole; *6* - soil destruction by water under pressure *7* - cement- mortar feed; *8* - rod; *9* - direction of pipeline feed of water and cement mortar; *10* -15 MPa;

STRENGTHENING OF FOUNDATION BED BY MEANS OF HYDROJET TECHNIQUE WITH FORMATION OF RING YOKE



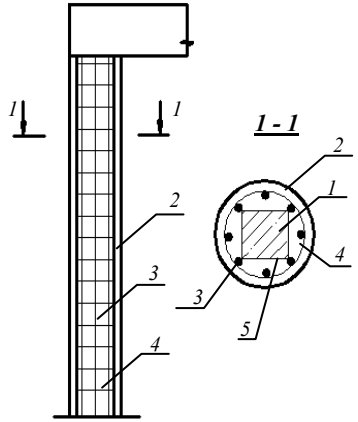
1 - existing foundation; *2* - ring cement-sand yoke for decreasing foundation settlement and for increasing foundation bearing capacity (to be made of cement or silty-cement mortar); *3* - silty, peat, dust or clay soil bed under strengthening; *4* - borehole contours; *5* - slot filled with mortar; *6* - jet monitor for feeding highhead water and cement mortar; *7* - nozzle for watter feeding

STREHGTHENING OF WATERSATURATED CLAY SOIL FOUNDATION BED BY MEANS OF ALKALIZATION



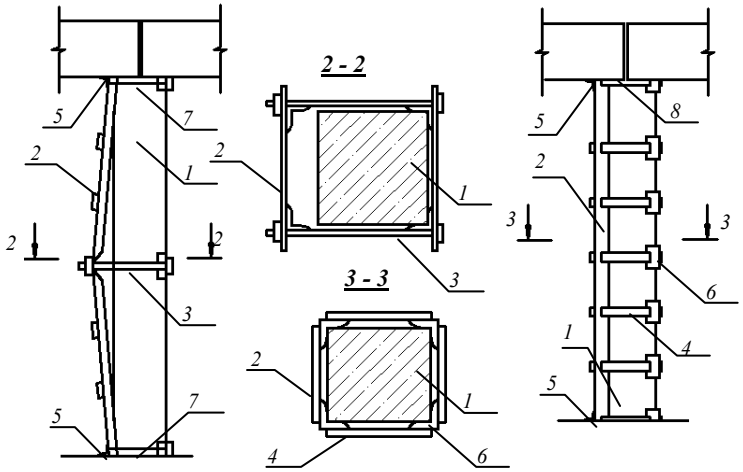
1 - existing foundation; *2* - injector sank from surface to feed alkali solution into soil (concentration- 7,5 density- 1,27 gr/cm3); *3* - zone of stabilized soil; *4* - bdirection of alkali distribution in soil mass

ARRANGEMENT OF REINFORCED CONCRETE YOKE WITH INDIRECT REINFORCING



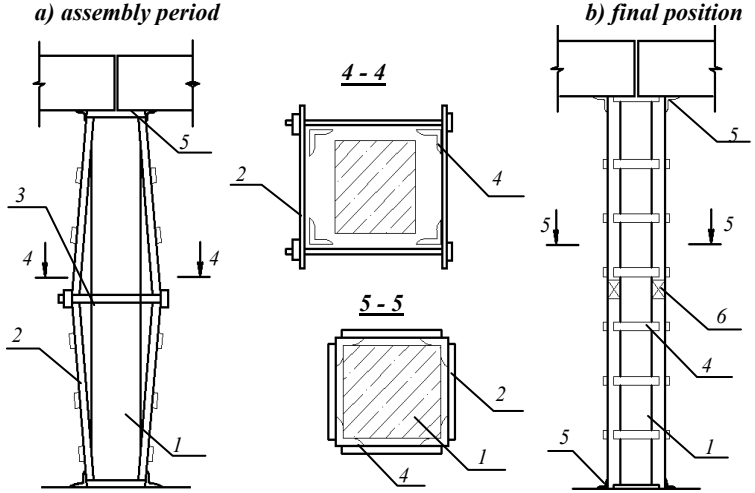
1 - column under strengthening; *2* - reinforced concrete yoke; *3* - longitudinal reinforcement of yoke; *4* - lateral indirect reinforcement of yoke; *5* - column surface prepared for concreting (cleandowned end hacked)

SETTING OF ONE-SIDED STRUTS



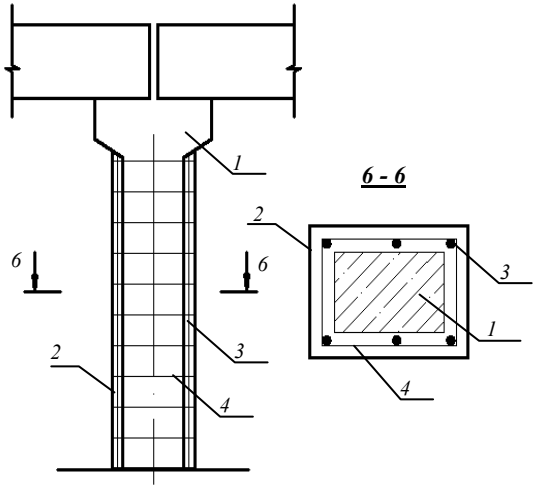
1 - column under strengthening; *2* - angle and plank strut; *3* - stressing assembling bolts; *4* - scabs to be welded after fitting the strut ; *5* - supporting angles; *6* - fastening angles; *7* - fastening assembling bolts; *8* - fastening rods replacing assembling bolts; *9* - notch in angle side flange to its bend point (should be welded by cover plate after fittingthe angle)

SETTING OF DOUBLE-SIDED STRUTS



1 - column under strengthening; *2* - angle and plank struts; *3* - stressing assembling bolts; *4* - scabs to be welded after fitting the struts; *5* - support members; *6* - cover plates welded onto strut angle flange cutouts

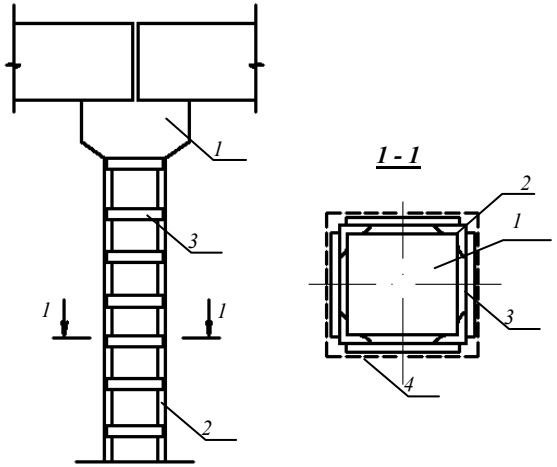
ARRANGEMENT OF REINFORCED CONCRETE YOKE



1 - column under strengthening; *2* - reinforced concrete yoke; *3* - longitudinal reinforcement; *4* - stirrups

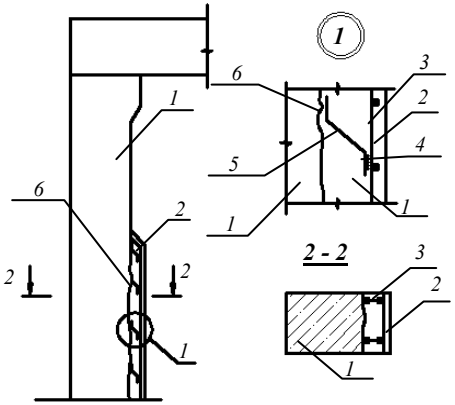
STRENGTHENIG OF REINFORCED CONCRETE COLUMNS

ARRANGEMENT OF METAL YOKE



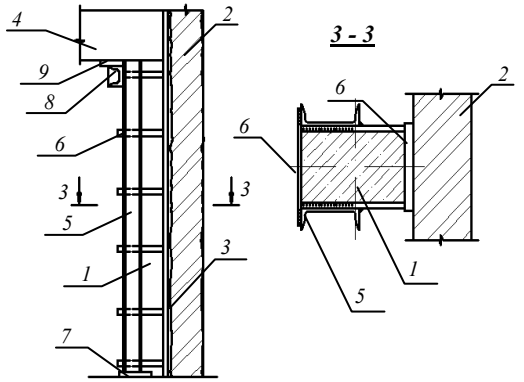
1 - column under strengthening; *2* - yoke angles; *3* - yoke planks; *4* - plastering on mesh

ARRANGEMENT OF REINFORCED CONCRETE SPLICING



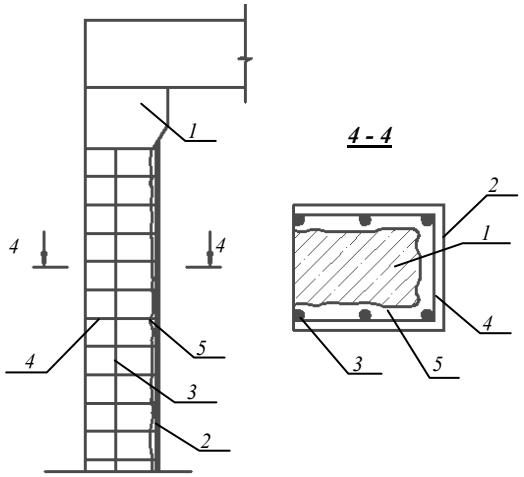
1 - column under strengthening; *2* - reinforced concrete splice; *3* - longitudinal reinforcement; *4* - stirrups; *5* - additional bent reinforcing bare; *6* - prepared column surface

SETTING OF SIDE RELIEVING MEMBERS



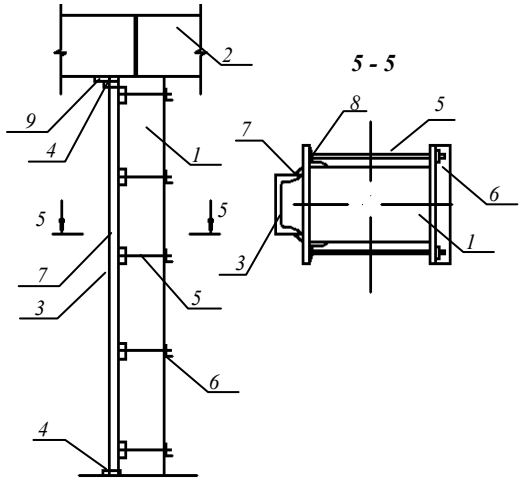
1 - column under strengthening; *2* - wall; *3* - clearance between wall and column; *4* - roof beam; *5* - side relieving channel members; *6* - scabs; *7* - supporting plate placed on mortar addition; *8* - supporting channel web with stiffening ribs; *9* - plate-wedges engaging relieving members into work

ARRANGEMENT OF REINFORCED CONCRETE JACKET



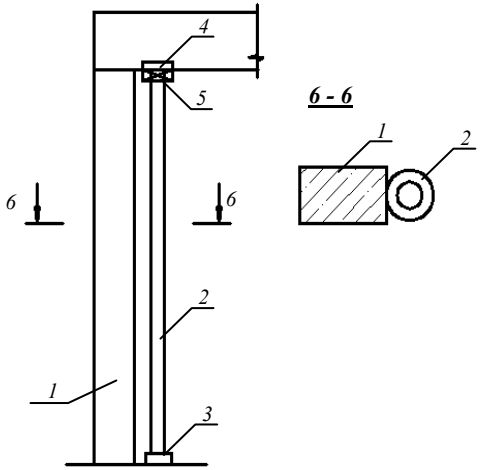
1 - column under strengthening; *2* - reinforced concrete jacket; *3* - longitudinal reinforcement; *4* - stirrups; *5* - prepared column; *6* - surface (hacked end cleandowned) work

SETTING OF ATTACHED RELIEVING POSTS



1 - column under strengthening; *2* - roof beam attached relieving channel post; *3* - supporting plates; *4* - coupling bolts; *5* – angle - washer; *6* - sheet of band; *7* - supporting angle of band; *8* - plate-wedges engaging reliving posts into work

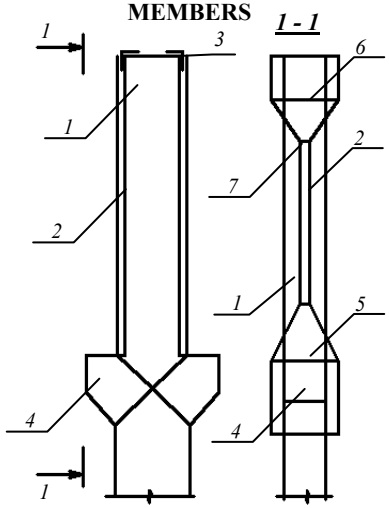
POSITIONING OF RELIEVING POSTS



1 - column under strengthening;*2* - relieving rolled metal post (pipe, channel, double tee); *3* - post lower support(base); *4* - post upper support (channel); *5* - items engaging poets into work (wedges, etc)

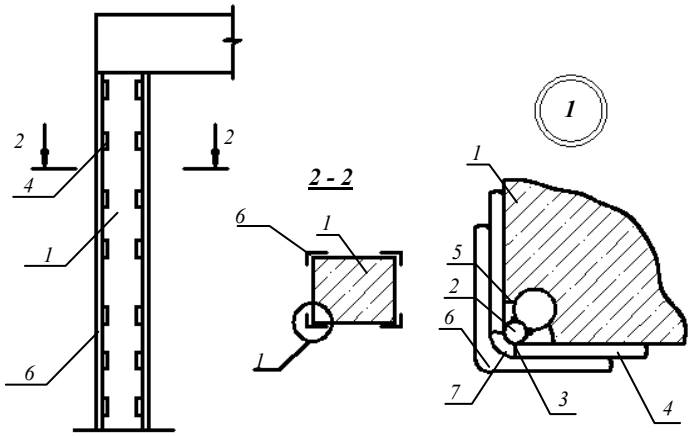
STRENGTHENING OF REINFORCED CONCRETE COLUMNS

SETTING OF PRESTRESSED STRENGTHENING MEMBERS



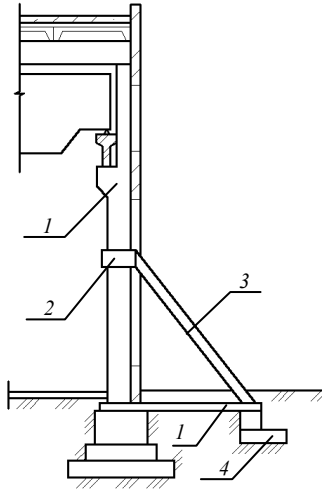
1 - column roof stanchion under strengthening; *2* - prestressed elements; *3* - head; *4* - column cantilever; *5* - pads; *6* - struts; *7* - tightening devices

WELDING OF METAL ANGLES TO COLUMN PRINCIPLE REINFORCEMENT



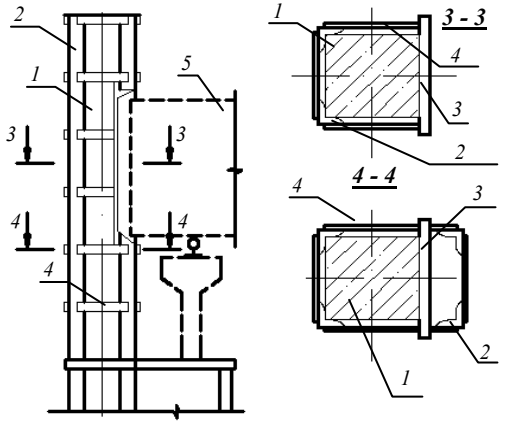
1 - column under strengthening; *2* - column principle reinforcement; *3*- short reinforcing rods 100 mm long welded to principle reinforcement (diameter is set according to position); *4* - metal plates welded to short reinforcing rods; *5* - protective concrete layer cut out in places of short rods welding; *6* - angles welded to plates; *7* - cavities to be filled with mortar

SETTING OF SUB-STRUTS



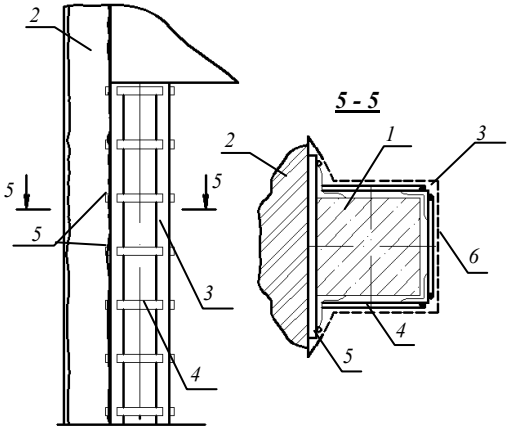
1 - column under strengthening; *2* - supporting stirrup for substrut fixing; *3* - sub-strut increasing column rigidity; *4* - substrut foundation; *5* - tie bar

SETTING OF METAL ANGLE AND SHEET YOKES



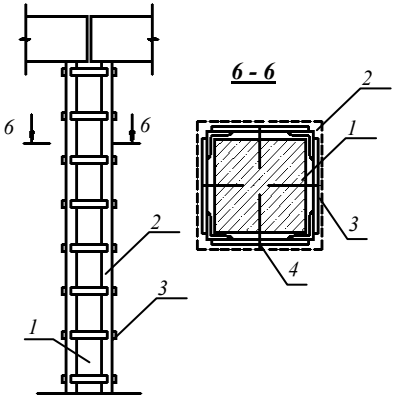
1 - column roof stanchion under strengthening with cutout for traveling crane; *2* - yoke angles; *3* - yoke sheet; *4* - cross planks of yoke; *5* - travelling crane

SETTING OF METAL YOKES IN CASE OF ADJACENT WALLS



1- column under strengthening; *2* - adjacent walls; *3* - yoke angles; *4* - cross planks of yoke; *5* - cross planks of yoke driven into joints between wall and column; *6* - plastering on mesh

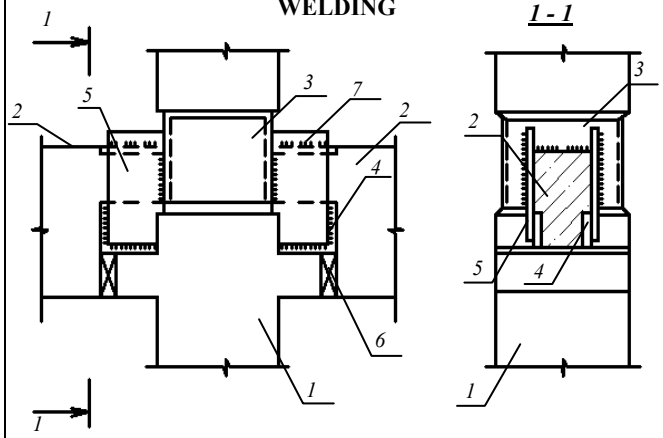
SETTING OF PRESTRESSED STIRRUPS



1 - column under strengthening; *2* - longitudinal angles of yoke placed on mortar and temporarily damped; *3* - prestressed cross planks (should be welded to angles after heating to 200-250°C); *4* - plastering on mesh

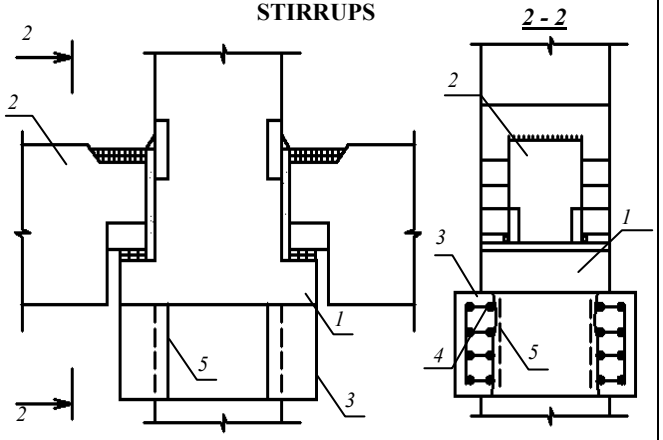
STRENGTHENING OF REINFORCED CONCRETE COLUMN CANTILEVERS

SETTING OF VERTICAL PLATES BY MEANS OF WELDING



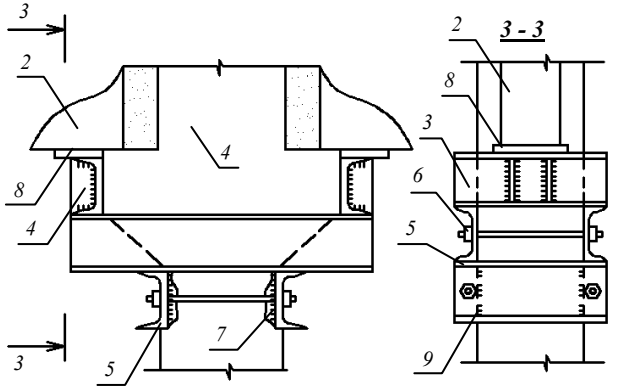
1 - cantilever under strengthening; *2* - cross-bars; *3* - column cast-in item; *4* - cross-bar cast-in items; *5* - steel plates welded to cross-bar and column cast-in items; *6* - metal plates for wedging out; *7* - welding

ARRANGEMENT OF REINFORCED CONCRETE YOKE-STIRRUPS



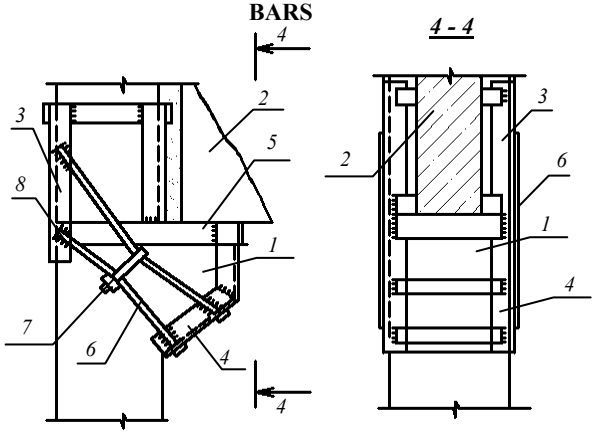
1 - cantilever under strengthening; *2* - cross-bars; *3* - reinforced concrete yoke-stirrup; *4* - horizontal closed reinforcement of yoke; *5* - protective concrete layer cut out in portion of column for yoke arrangement

POSITIONING OF SUPPORTING CHANNEL PROPS



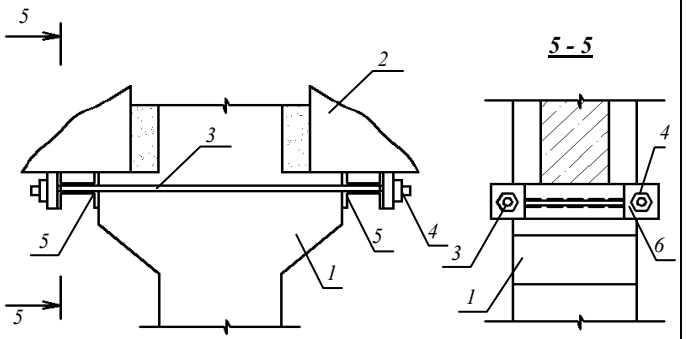
1 - cantilever under strengthening; *2* - cross-bars; *3* - channel prop; *4* - stiffening ribs; *5* - channel prop supports welded to exposed principle reinforcement of column; *6* - coupling bolts;*7* - exposed principle reinforcement of column; *8* - plate- wedges engaging the props into work; *9* - welding

SETTING OF MUTUALLY TIGHTENING TENSION BARS



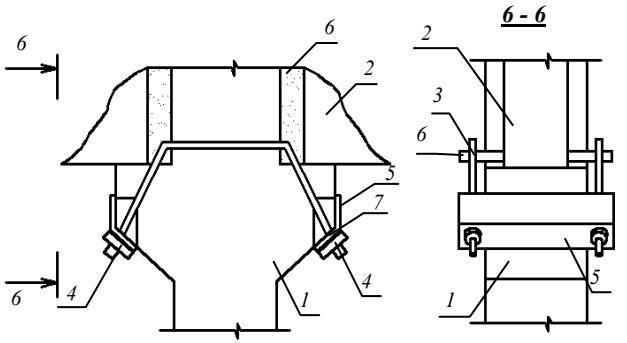
1 - cantilever under strengthening; *2* - cross-bars; *3* - upper short yoke made of angles; *4* - lower support; *5* - horizontal fringing stirrup; *6* - mutually tightening tension bars; *7* - band; *8* - welding

SETTING OF HORIZONTAL TENSION BARS



1 - cantilever under strengthening; *2* - cross-bars; *3* - prestressed tension bars; *4* - nuts; *5* - channel beams; *6* - plank-washers for tension bars fastening

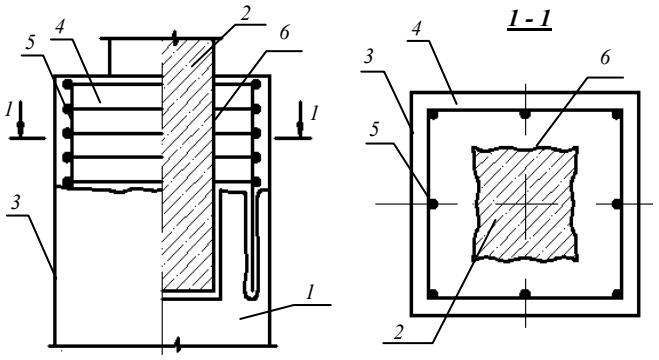
SETTING OF SLOPING TENSION BARS



1 - cantilever under strengthening; *2* - cross-bars; *3* - prestressed tension bars; *4* - nuts; *5* - lower support from plates; *6* - upper support from rods and plates; *7* - sloping washers

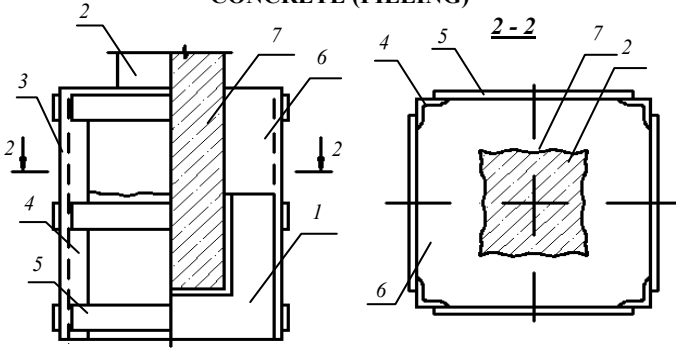
STRENGTHENING OF COLUMN-TO-FOUNDATION CONNECTION UNITS

SPLICING OF COLUMN HOUSING WALLS BY REINFORCED CONCRETE YOKE



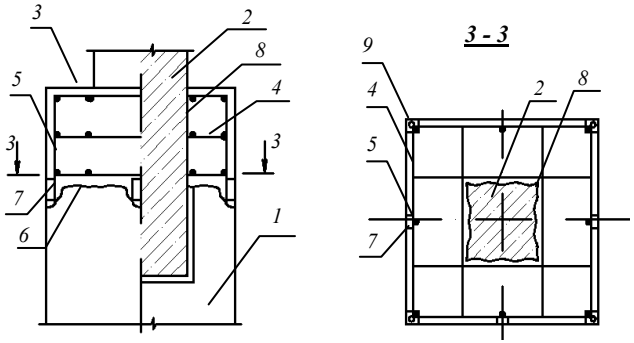
1 - column foundation housing; *2* - column; *3* - reinforced concrete yoke of housing walls splice; *4* - lateral reinforcement of splice; *5* - periodical profile vertical reinforcement placed on mortar in drilled holes; *6* - column and column foundation housing surface prepared for concreting (clean downed and hacked)

ARRANGEMENT OF METAL YOKE PILLED WITH CONCRETE (FILLING)



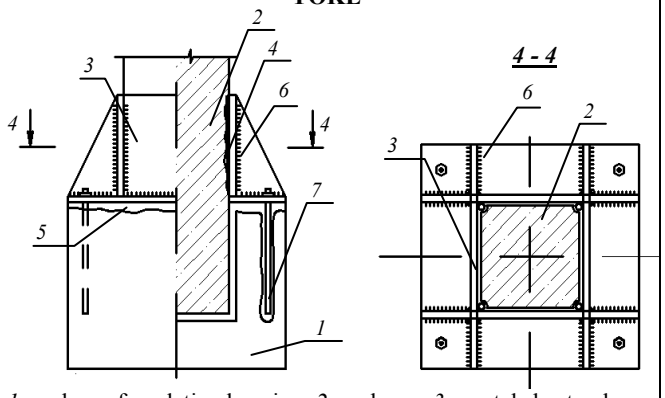
1 - column foundation housing; *2* - column; *3* - strengthening metal yoke; *4* - yoke longitudinal angles placed on column foundation housing by means of mortar; *5* - yoke cross planks; *6* - grouting concrete; *7* - column and column foundation housing surface prepared to concreting (cleanndowned and hacked)

SPLICING OF COLUMN HOUSING WALLS BY REINFORCED CONCRETE YOKE



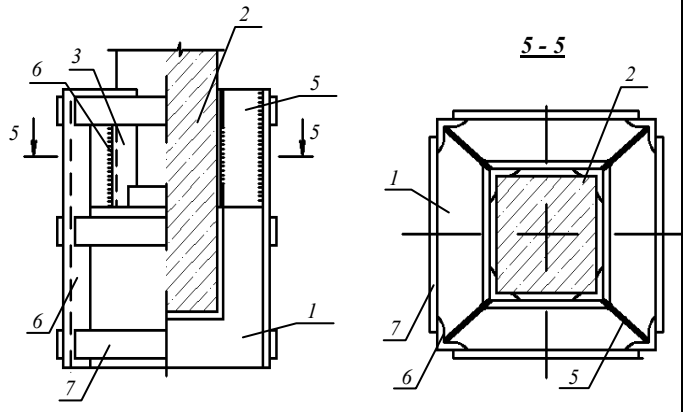
1 - column foundation housing; *2* - column; *3* - reinforced concrete yoke of housing walls splice; *4* - lateral reinforcement of splice; *5* - vertical reinforcement of splicing; *6* - exposed vertical reinforcement of housing walls; *7* - reinforcing cover plate welded to housing wall reinforcement and splice reinforcement; *8* - surface of column and upper portion of housing prepared to concreting; *9* - grouting of exposed reinforcement with dense mortar

SPLICING OF COLUMN HOUSING WALLS BY METAL YOKE



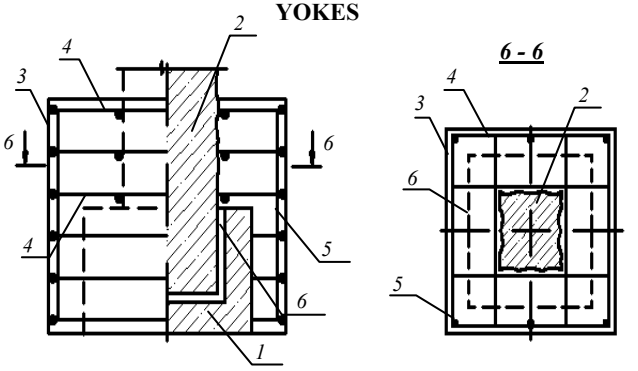
1 - column foundation housing; *2* - column; *3* - metal sheet yoke of housing wall splice welded to exposed reinforcement of column; *4* - reinforcing short rods; *5* - supporting slab placed on mortar addition; *6* -stiffening ribs; *7* - anchor bolts

ARRANGEMENT OF METAL YOKE



1 - column foundation housing; *2* - column; *3* - metal yoke on column; *4* - metal yoke on column foundation housing; *5* - welded steel plates placed between yokes; *6* - yoke longitudinal angles placed on mortar;*7* - yoke cross planks after heating to 200°C welded to

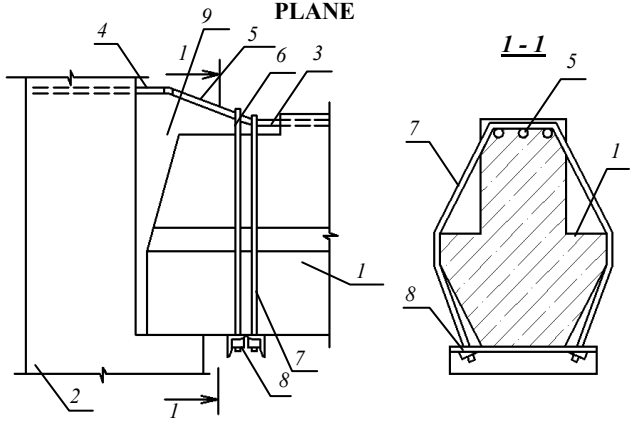
ARRANGEMENT OF REINFORCED CONCRETE YOKES



1 - column foundation housing; *2* - column; *3* - strengthening reinforced concrete yoke; *4* - lateral reinforcing fabric of yoke; *5* - vertical reinforcing rods of yoke; *6* - column and column foundation housing surface prepared for concreting (cleandowned and hacked)

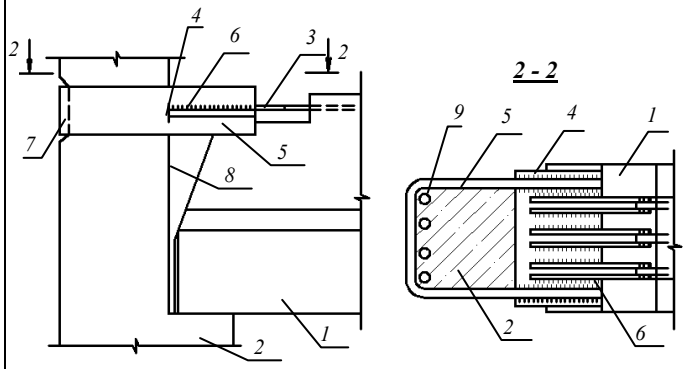
STRENGTHENING OF JOINTS BETWEEN REINFORCED CONCRETE CROSS-BARS AND COLUMNS

ACHIEVING OF CROSS-BAR-TO-COLUMN RIGID JOINT WHEN PSOTRUDING RODS HAVE NO MORE THAN 50 mm DIFFERENCE IN LENGTH VERTICAL PLANE



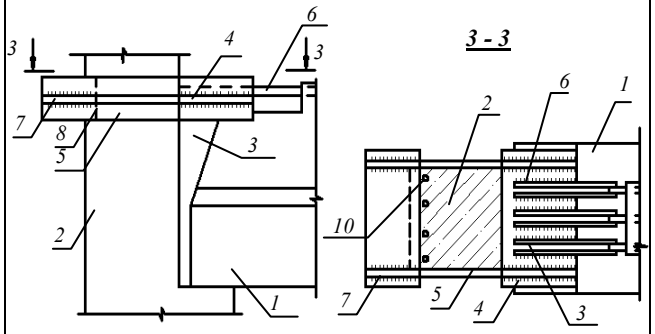
1 - cross-bar; *2* - column; *3* - cross - bar protruding rods; *5* - butt reinforcing inserts; *6* - butt welding; *7* - anchor stirrups; *8* - angle washers; *9* - concrete grout

ACHIEVEMENT OF CROSS-BAR - TO - COLUMN RIGID JOINT IN THE ABSENCE OF OPPORTUNITY TO USE COLUMN PROTRUDING RODS



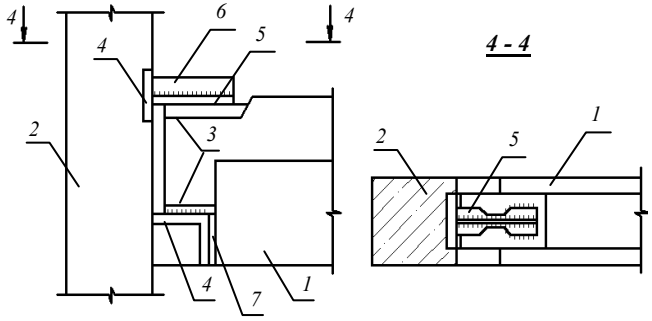
1 - cross-bar; *2* – column; *3* - cross- bar protruding rods; *4* - horizontal sheet; *5* - stirrup-tension bar; *6* - butt reinforcing inserts; *7* - cut out concrete cover; *8* - concrete grout; *9* - column exposed reinforcement

ACHIEVING OF CROSS-BAR-TO-COLUMN RIGID JOINT IN THE ABSENCE OF PROTRUDING TO USE COLUMN PROTRUDING RODS



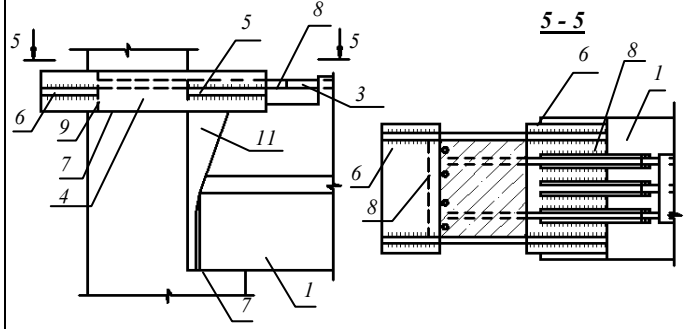
1 - cross-bar; *2* - column; *3* - cross-bar protruding rods; *4* - horizontal sheet; *5* - plank-tension bar; *6* - butt reinforcing inserts; *7* - anchor ribs; *8* - cut out concrete cover; *9* - concrete grout; *10* - column exposed reinforcement

STRENGTHENING OF CROSS-BAR - TO - COLUMN RIGID JOINTS BY WELDING THE ADDITIONAL COVER PLATES AND BY WEDGING OUT



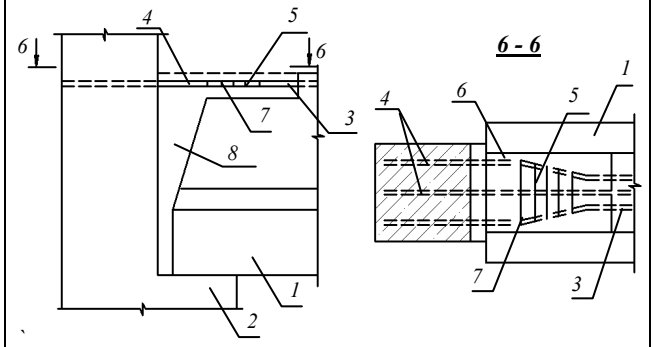
1 - cross-bar; *2* - column; *3* - cross-bar cast-in items; *4* - column cast-in items; *5* - butt cover plate ("fish"); *6* - additional butt cover plate; *7* - joint between cantilever and cross-bar wedges out by metal

ACHIEVEMENT OF CROSS-BAR - TO - COLUMN RIGID JOINT WHEN COLUMN PROTHUDING RODS ARE NOT LONG ENOUGH



1 - cross bar; *2* - column; *3* - cross-bar protruding rods; *4* - column protruding rods; *5* - horizontal sheet; *6* - anchor rib; *7* - plate-tension bar; *8* - butt reinforcing inserts; *9* - cut out concrete cover; *10* - column exposed reinforcement; *11* - concrete grout

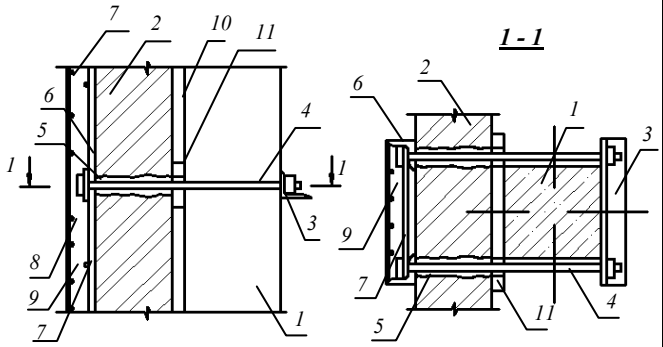
ACHIEVING OF CROSS-BAR-TO-COLUMN RIGID JOINT IN THE ABSENCE OF LENGTH COINCIDENCE IN PROTRUDING RODS IN HORIZONTAL PLANE



1 - cross-bar; *2* - column; *3* - cross-bar protruding rods; *4* - column protruding rods; *5* - butt reinforcing inserts; *6* - butt welding; *7* - tie stirrups; *8* - concrete grout

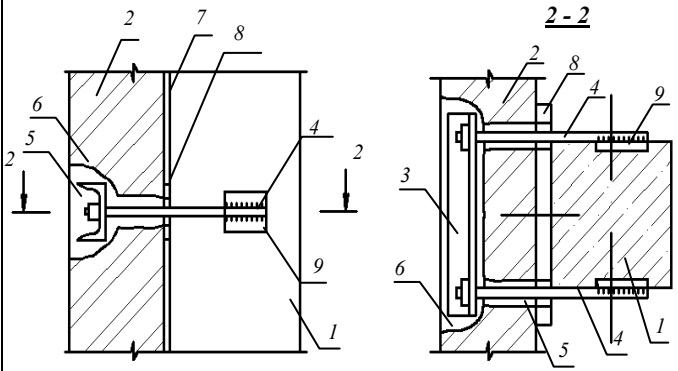
RECOVERING OF WALL-TO-COLUMN CONNECTION UNITS

ATTACHMENT OF BRICK WALLS



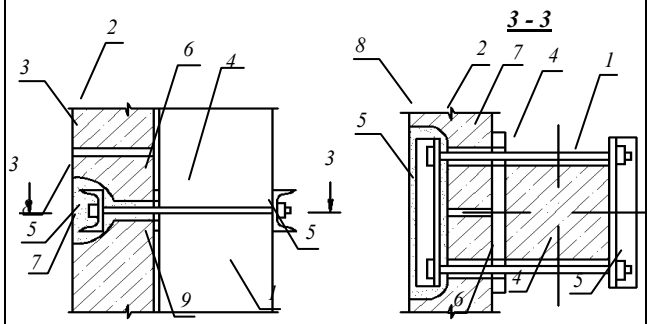
1 - column; *2* - brick wall; *3* - angle; *4* - coupling bolts; *5* - holes for bolts drilled in the wall; *6* - angle-anchors of bolts; *7* - cross planks; *8* - reinforcing fabric; *9* - cement-sand plaster; *10* - clearance bet-ween column and wall; *11* - plate-pads between wall and column

ATTACHMENT OF BRICK WALLS



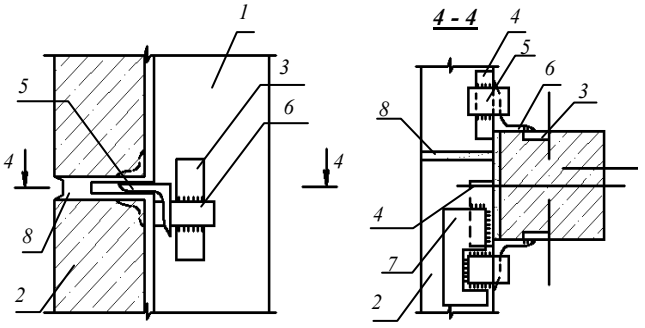
1 - column; *2* - brick wall; *3* - channel; *4* - coupling bolts; *5* - holes for bolts drilled in the wall; *6* - groove cut out in the wall (to be grouted in with dense cement-sand mortar after attaching the walls); *7* - clearance between column and wall; *8* - plate-pads between wall and column; *9* - column cast-in item

ATTACHMENT OF WALLS IN THE ABSENCE OF CAST-IN ITEMS IN COLUMNS AND WALL PANELS



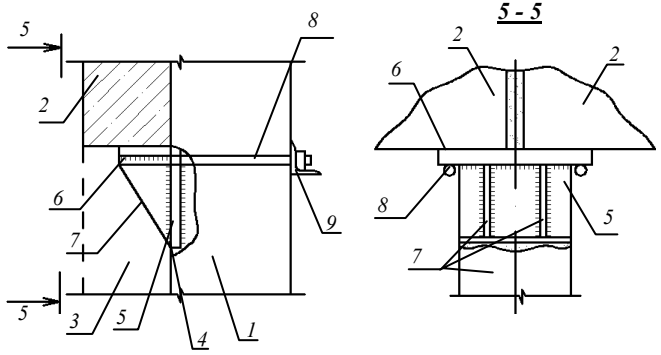
1 - column; *2* - wall panels; *3* - interpanel joint; *4* - coupling bolts; *5* - channel; *6* - plate-pads between wall and column; *7* - holes for bolts in the wall; *8* - groove cut out in wall panels (should be concreted after attachment of the walls); *9* - clearance between column and wall

HANGING OF WALL PANELS IN CONDITIONS OF COLUMN DISPLACEMENT



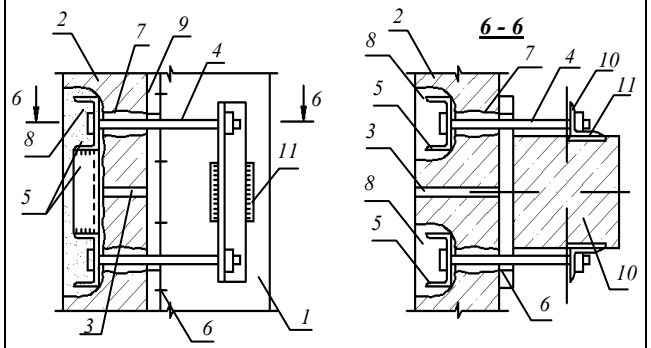
1 - column; *2* - wall panels; *3* - column cast-in items; *4* - panel cast-in angles; *5* - angle-grabs welded to panel cast-in angles; *6* - angle-jigs welded to column cast-in items; *7* - corrugated sheet for angle-jigs fastening in conditions of panel cast-in angles displacement; *8* - interpanel joint filled with concrete reinforcement

POSITIONING OF SUPPORTING PROPS UNDER HANGING PANELS



1 - column; *2* - hanging wall panels; *3* - strip glazing zone; *4* - groove on column surface cut deep to principle reinforcement; *5* - supporting prop sheet welded to column exposed reinforcement; *6* - supporting prop flange; *7* - stiffening ribs; *8* - coupling bolts; *9* - anchor angle

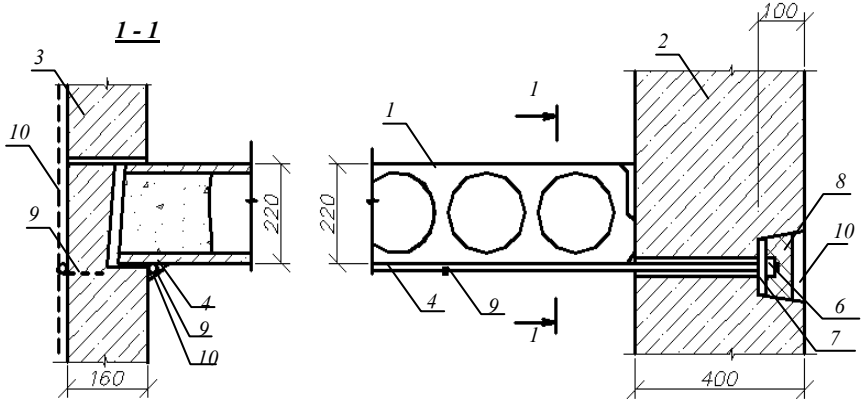
ATTACHMENT OF WALLS TO COLUMNS IN THE ABSENCE OF CAST-IN ITEMS IN WALL PANELS



1 - column; *2* - wall panels; *3* - interpanel joint; *4* - coupling bolts; channel; *5* - plate-pads between wall and column; 6 - holes for bolts in the wall; *7* - groove cut out in wall panels (should be concreted after attachment of the walls); *8* - clearance between column and wall; *9* - angle; *10*- column cast-in item

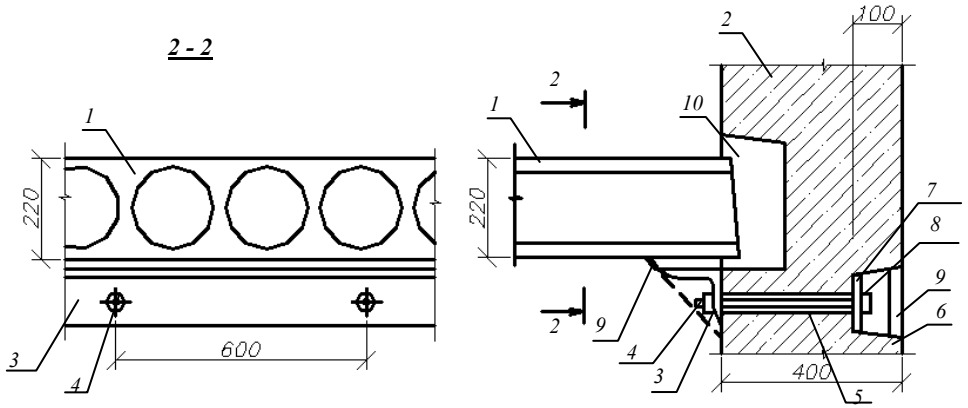
STRENGTHENING OF CONNECTION JOINTS OF LARGE PANEL BUILDING EXTERNAL WALLS

STRENGTHENING OF EXTERNAL NON-BEARING WALL PAHEL - TO WALL PANEL CONNECTION JOINTS



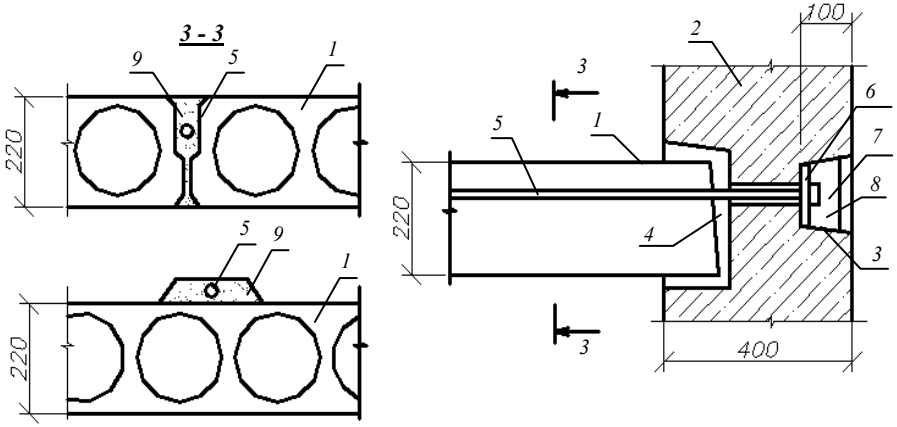
1 - core floor slabs; *2* - external non-bearing panels; *3* - staircase wall panels; *4* - reinforcing steel tension bar; *5* - hole in the wall for tension bar; *6* - 150x150x100 mm recess in the wall; *7* - washer; *8* - warmth-keeper lagging (felt); *9* - hooks for tension bars suspension, 10 - plaster

STRENGTHENING OF SUPPORT UNITS OF FLOOR SLABS ON EXTERNAL BEARING WALLS



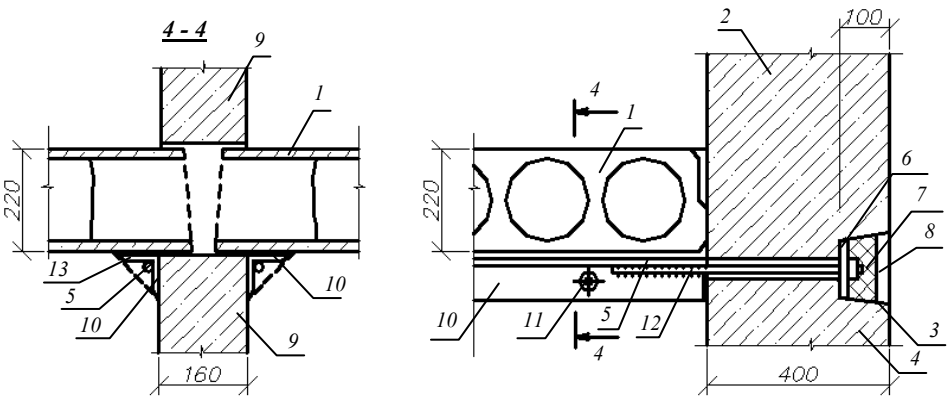
1 - core floor slabs; *2* - external bearing wall panel;*3* - additional angle support for floor slabs; *4* - coupling bolts; *5* - holes in the wall for bolts; *6* - recess in the wall; *7* - washer; *8* - warmth-keeper lagging (felt); *9* - plaster; *10* - M100 cement-sand mortar

STRENGTHENING OF EXTERNAL BEARING WALL PANEL - TO - FLOOR PANEL CONNECTION JOINTS



1 - core floor slabs; *2* - external bearing wall panel; *3* - recess in the wall; *4* - hole in the wall for tension bar; *5* - reinforcing steel tension bar; *6* - washer; *7* - warmth keeper lagging (felt); *8* - plaster; *9* - M100 cement-sand mortar

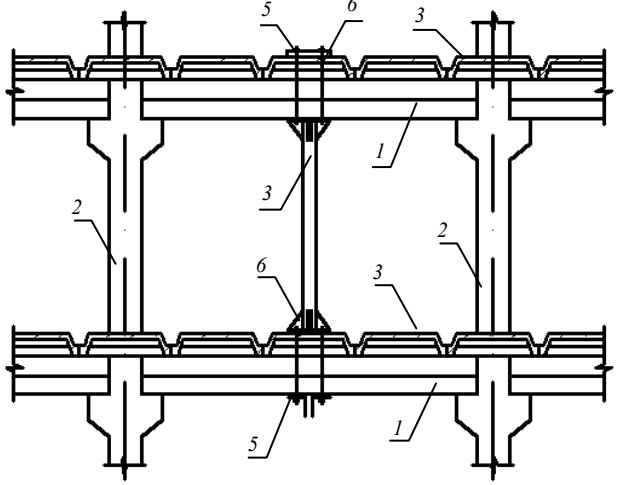
STRENGTHENING OF EXTERNAL NON-BEARING WALL PANEL - TO INTERNAL BEARING WALL PANEL CONNECTION JOINTS



1 - core floor slabs; *2* - external non-bearing panel; *3* - recess in the wall; *4* - hole in the wall for tension bar; *5* - reinforcing steel tension bar; *6* - washer; *7* - warmth-keeper lagging (felt); *8* - plaster; *9* - internal bearing con-crete wall panels; *10* - angles fixed to wall panels by coupling bolts; *11*- coupling bolts; *12* - welding; *13*- plaster

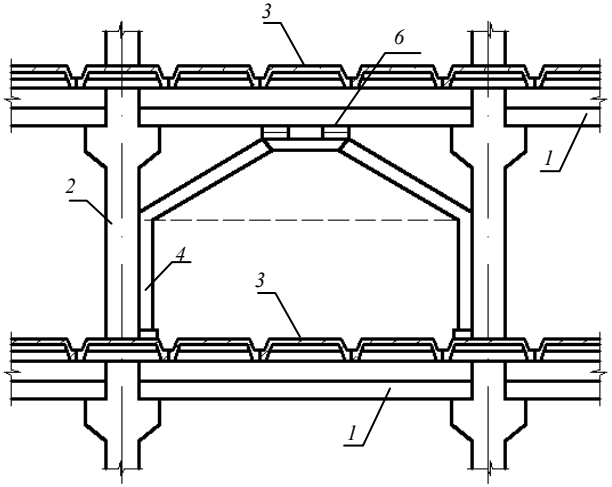
STRENGTHENING OF REINFORCED CONCRETE MULTY-STOREY FRAMES

SETTING OF POSTS BETWEEN FLOOR CROSS-BARS



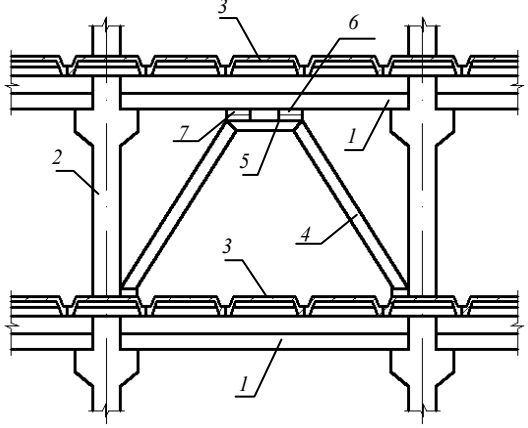
1 - frame cross-bars; *2* - frame columns; *3* - floor slabs; *4* - metal post between floor cross-bars (pipe, double-tee, channel or angle box); *5* - anchor devices for posts; *6* - holes for anchor

SETTING OF FRAMES



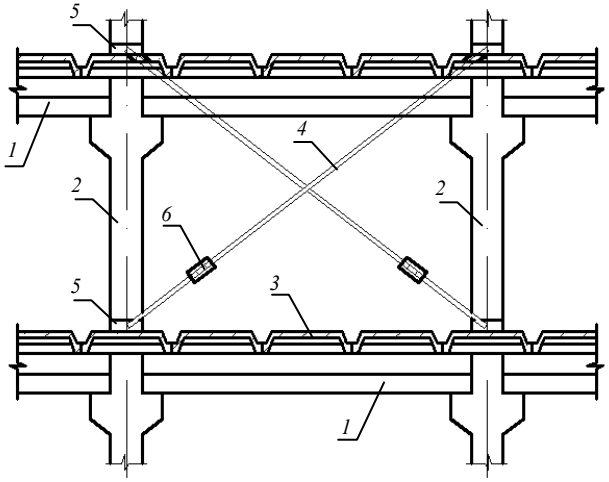
1 - frame cross-bars; *2* - frame columns; *3* - floor slabs; *4* – strengthening precast reinforced concrete or metal frame; *5* - tie; *6* - plate-wedges for engaging strengthening frame into work

SETTING OF SUB-DIAGONALS



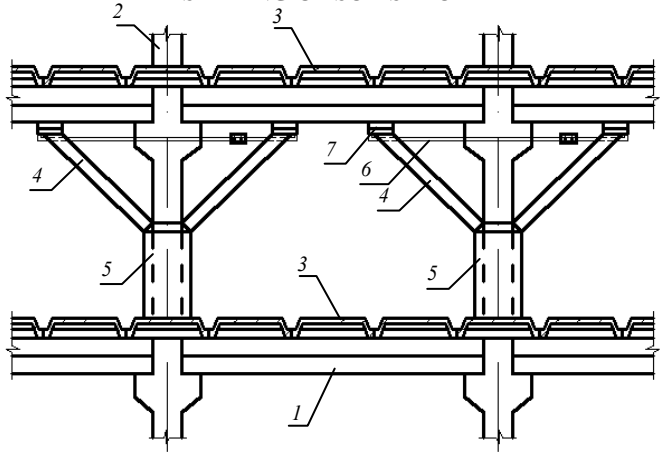
1 - frame cross-bars; *2* - frame columns; *3* - floor slabs; *4* - strengthening reinforced concrete or metal sub-struts; *5* - tie rod welded to sub-struts after their engaging into work (thrust is performed by jacks); *6* - steel sheet; *7* - steel sheet pad on graphite lubrication

SETTING OF FLEXIBLE CROSS BRACINGS



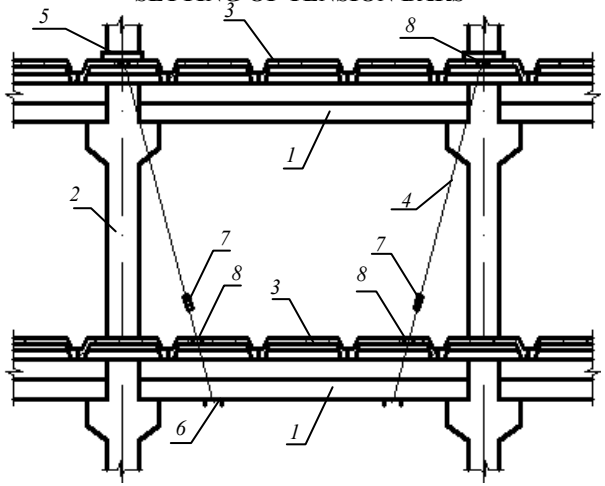
1 - frame cross-bare; *2* - frame columns; *3* - floor slabs; *4* - flexible cross bracings; *5* - metal yoke-type anchor devices; *6* - turnbuckle; *7* - holes for anchor

SETTING OF SUB-STRUT



1 - frame cross-bars; *2* - frame columns; *3* - floor slabs; *4* – strengthening reinforced concrete or metal substruts; *5* - reinforced concrete yokes (supports for sub-struts); *6* - tension bars with couplings; *7* - steel sheet; *8* - steel sheet pad on graphite lubrication

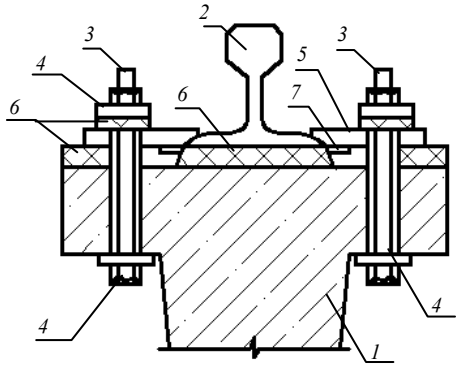
SETTING OF TENSION BARS



1 - frame cross-bars; *2* - frame columns; *3* - floor slabs; *4* - tension bars; *5* - metal yoke-type anchor devices on columns; *6* - channel beam-type anchor

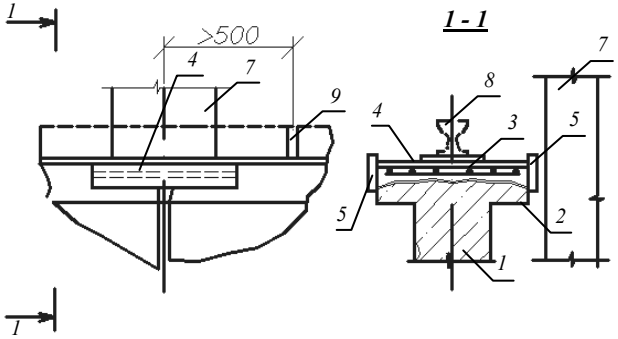
RESTORING OF REINFORCED CONCRETE CRANE BEAMS

REPAIRING OF CRANE RAILS FASTENING



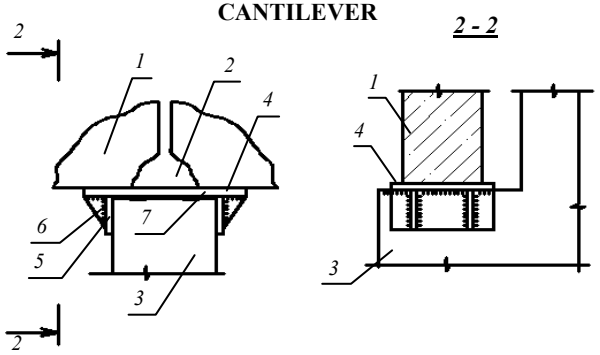
1 - crane beam; *2* - crane rail; *3* - fastening bolts; *4* - bolt washers; *5* - clamp; *6* - elastic pad; *7*- elastic pad spacer

REPAIRING OF TOP EDGE SECTIONS OF BEAMS



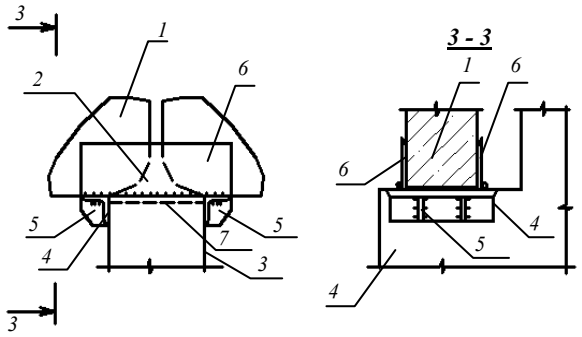
1- crane beams; *2* - damaged top sections of beams; *3* - restoring of damaged sections by mesh concreting; *4* - supporting metal plate set on mortar; *5* - side wall-limiters; *6* - spacer welded to supporting sheet (encased in the joint between beams); *7* - column; *8* - rails; *9* - rail junction

STRENGTHENING OF DAMAGED SUPPORTS IN THE ABSENCE OF CAST-IN ITEM IN COLUMN CANTILEVER



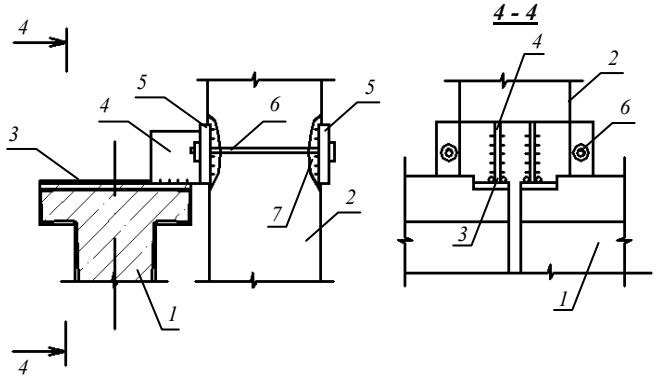
1 - crane beams; *2* - damaged supports of crane beams; *3* - column cantilever; *4* - prop sheet placed on mortar layer (beams should be uplifted); *5* - side fixing sheets; *6* - stiffening ribs; *7*- leveling mortar layer

STRENGTHENING OF DAMAGED SUPPORTS



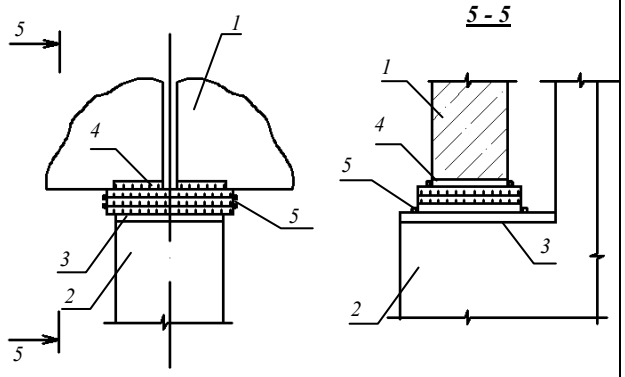
1 - crane beams; *2* - damaged supports of crane beams; *3* - column cantilever; *4* - angle props; *5* - stiffening ribs; *6* - rib-rockers; *7*- cast-in item of column cantilever

RESTORING OF BEAM FLANGES FASTENING TO COLUMNS



1 - crane beam; *2* - column;*3* - cast-in items of crane beam; *4* - rib-ties; *5* - plates of restored cast-in item on column, placed on mortar; *6* - coupling bolts; *7* - groove cut in protective concrete layer of column

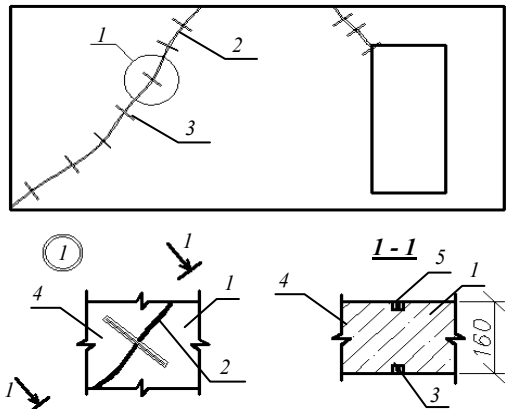
SETTING OF LEVELING SUPPORTING PADS



1 - crane beams; *2* - column cantilever; *3* - cast-in item of column cantilever; *4* - cast-in items of crane beams; *5* - set of leveling sheet pads (should be welded with each other, with cast-in items of beams and column cantilever)

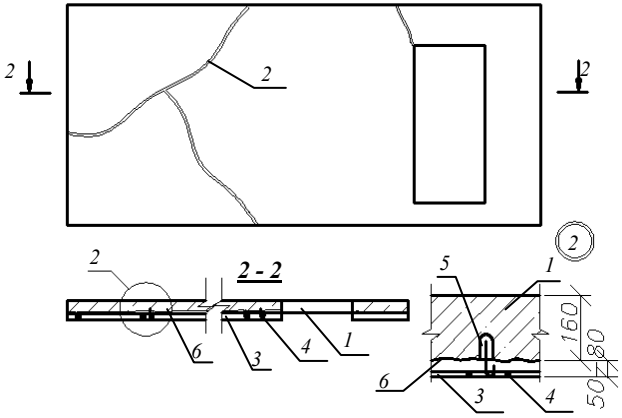
STRENGTHENING OF CONCRETE WALL PANELS

ARRANGEMENT OF GLUED COVER PLATES OF REINFORCEMENT



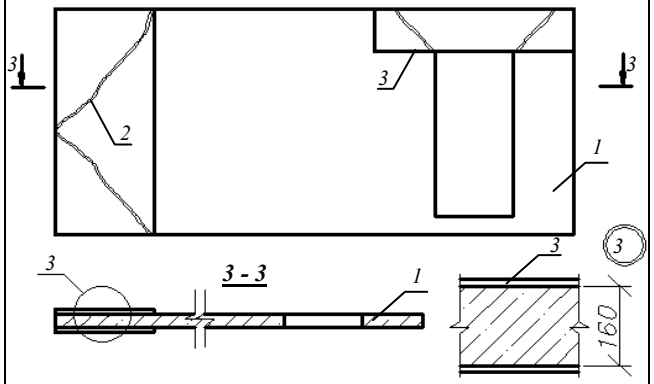
1 - concrete panel under strengthening; *2* - cracks in panel; *3* - 3 to 5 mm diameter reinforcing rods; *4* - groove milled in concrete; *5* - protective structural polymer mortar

PANEL CONCRETING



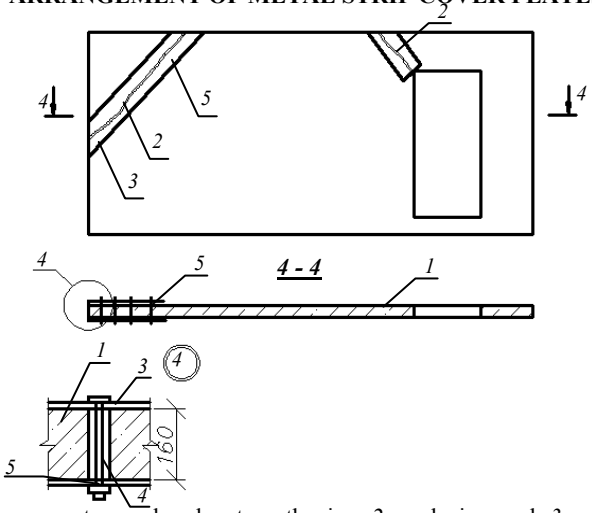
1- concrete panel under strengthening; *2* - cracks in panel; *3* - B30 class new concrete layer 50 to 80 mm thick; *4* - reinforcing fabric; *5* - anchor ties (spaced at 1,0 m); *6* - prepared panel surface (hacking, adhesive layer, polymer mortar, etc.)

GLASS CLOTH GLUEING



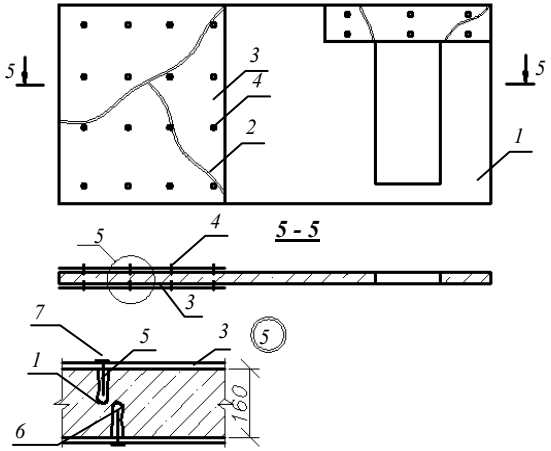
1 - concrete panel under strengthening; *2* - cracks in panel; *3* - glass cloth glued to protective constructional polymer mortar (several layers)

ARRANGEMENT OF METAL STRIP COVER PLATES



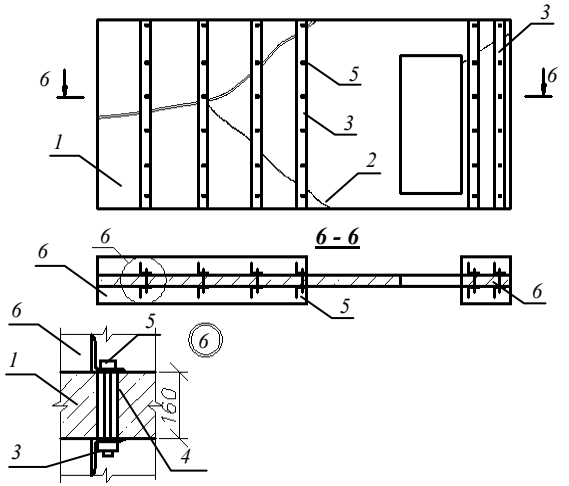
1 - concrete panel under strengthening; *2*-cracks in panel; *3* - metal strip cover plates; *4* - 14 mm diameter holes in slab; *5* - M12 bolts

METAL STRIP GLUEING



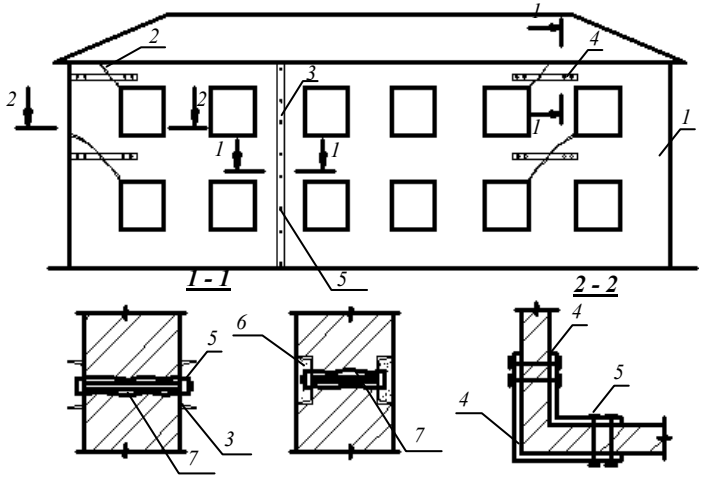
1 - concrete panel under strengthening; - cracks in panel; *3*- metal sheet 1 to 2 mm thick; *4* - anchors 10 mm in diameter and 80 mm long; *5* - pockets drilled in concrete; *6* - polymer mortar; *7* -welding

ARRANGEMENT OF METAL ANGLE COVER PLATES



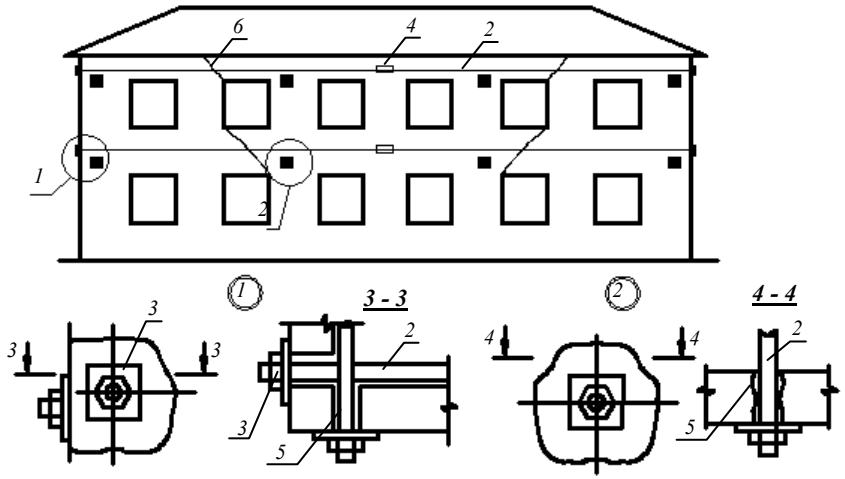
1 - concrete panel under strengthening; *2* - cracks in panel; *3* - metal angles with holes; *4* - 14 mm diameter holes in panel; *5* - M12 bolts; *6* - additional finishing (plastering, sheathing, etc.)

PLACING OF METAL COVER PLATES



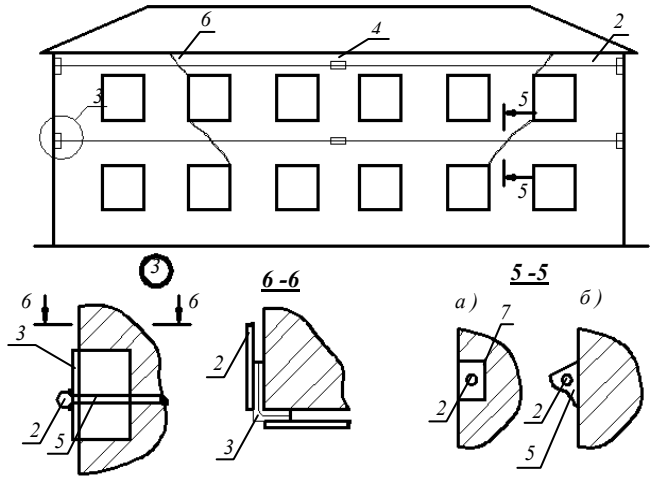
1- deformed building; *2* - cracks in walls; *3* - channel cover plates; *4* - metal cover plates; *5* - coupling bolts; *6* - joggle for cover plates filled with mortar; *7* - holes in walls for bolts (to be caulked by mortar after fastening the bolts)

ARRANGEMENT OF STRESSED CHORDS FROM THE INTERIOR OF THE BUILDING



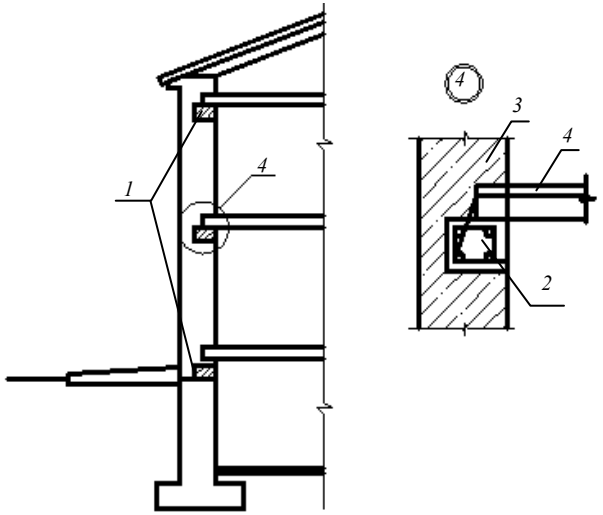
1 - deformed building; *2* - steel tension bars with nuts; *3* - metal plates; *4* - tumbuckles; *5* - holes in walls to be grouted after fixing the tension bars; *6* - cracks in walls

ARRANGEMENT OF STRESSED CHORDS FROM THE EXTERIOR OF THE BUILDING



1 - deformed building; *2*- steel tension bars; *3*- rolled shape made of 150x150 angle; *4*- tumbuckles; *5* - welded joint; *6* - cracks in walls; *7* - joggle in the wall for tension bar filled with cement-sand mortar; *8* - cement-sand mortar intermediate cornice

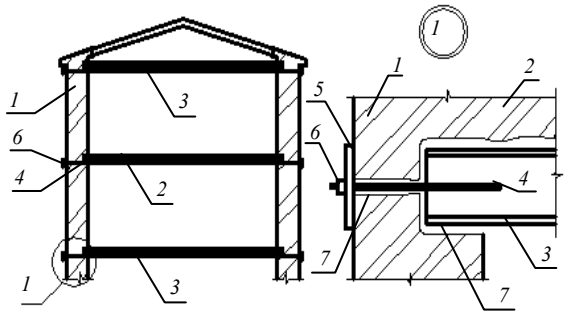
ARRANGEMENT OF REINFORCED CONCRETE CHORDS



1 - reinforced concrete chords; *2* - scheme of reinforcement arrangement in the chord; *3* - metal anchor; *4* - reinforced concrete floor slab

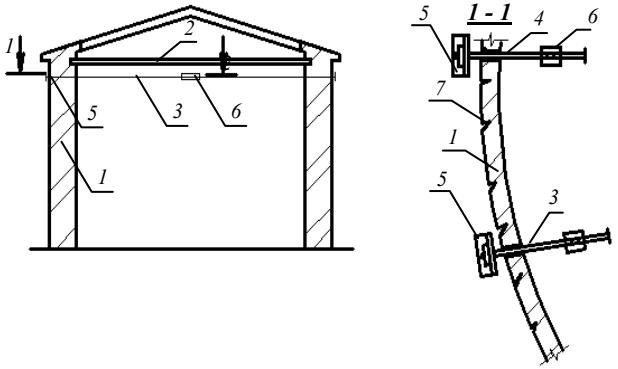
STRENGTHENING OF BRICK WALLS

SETTING OF SINGLE-STOREY TIE-STRUTS



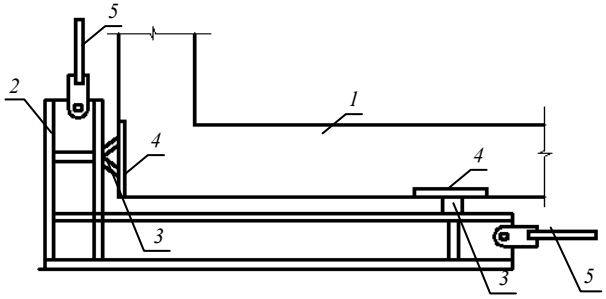
1 - walls; *2* - floors; *3* - rolled metal tie- struts (channel, double-tee, angle); *4* - threaded tension bar welded to tie- struts; *5* - washer; *6* - nut for tensioning; *7* - holes and recesses in walls (to be filled with cement-sand mortar after fixing tension bars and tie-struts)

SETTING OF METAL TENSION BARS



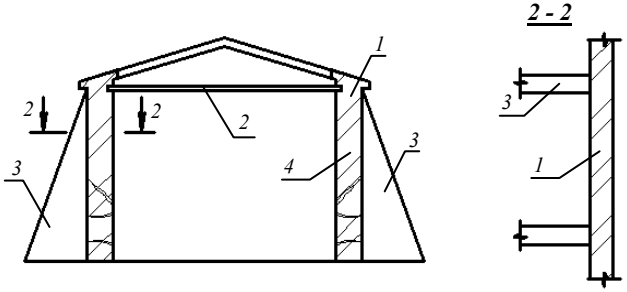
1 -building wall; *2* - covering; *3* - tension bars; *4* - holes in walls (to be filled with cement-sand mortar after fixing the tension bars); *5* - channel traverse; *6* - tension coupling; *7* - cracks in the wall

SETTING OF HORIZONTAL HAULAGES WITH ALIGNING ELEMENTS IN THE CORNERS



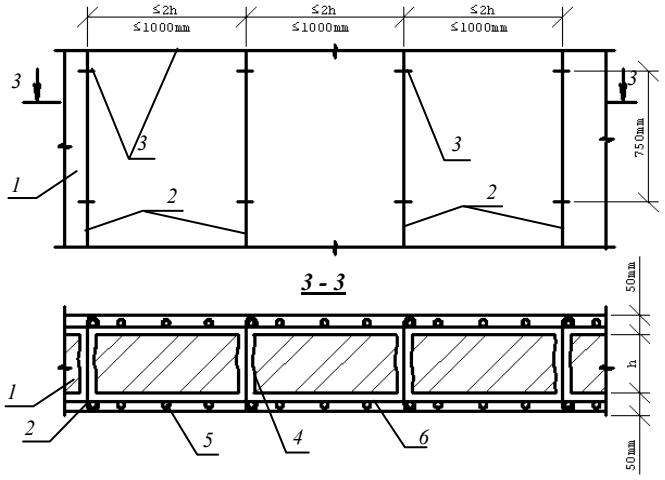
1 - walls under strengthening; *2* - Г-shaped supporting members set in the building comers; *3* - aligning elements; *4* - distributing slabs; *5* - haulages

SETTING OF COUNTERFORTS



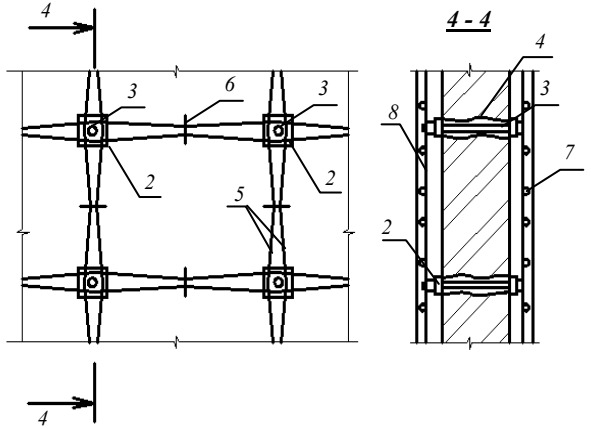
1 - walls deflected from vertical position; *2* - covering; *3* - brick or concrete counterforts; *4* - cracks in the wall

ARRANGEMENT OF REINFORCED CONCRETE YOKE



1 - wall under strengthening; *2* - 10 to 14 mm diameter reinforcing rods; *3* - 10 mm diameter stirrup-ties; *4* - holes in the wall; *5* - reinforcing fabric tied to reinforcing rods; *6* - yoke concrete

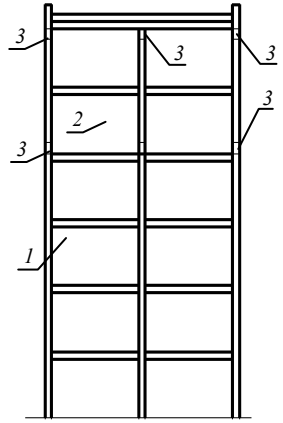
ARRANGEMENT OF PRESTRESSED PLASTER YOKE



1 - wall under strengthening; *2* - metal plates with holes for tension bars; *3* - tension bar-ties; *4* - holes in the wall for tension bars; *5* - reinforcing rods welded to plates and tied in pairs; *6* - cramps; *7*- reinforcing fabrics tied to rods; *8* - cement-sand mortar plastering

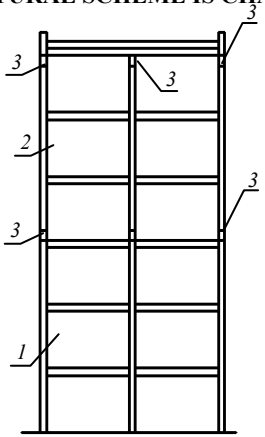
STRUCTURAL SCHEME OF RECONSTRUCTION WORK ON HEIGHTENING BUILDINGS AND STRUCTURES

STRUCTURAL SCHEME IS PRESERVED



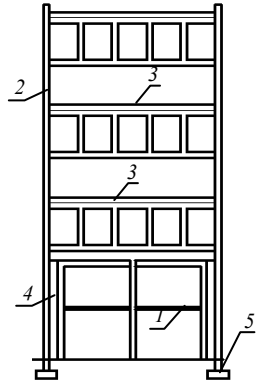
1 - existing building; *2* - addition to building (structural scheme is preserved); *3* - chords of rigidity in the addition (along the perimeter of longitudinal and cross walls)

STRUCTURAL SCHEME IS CHANGED



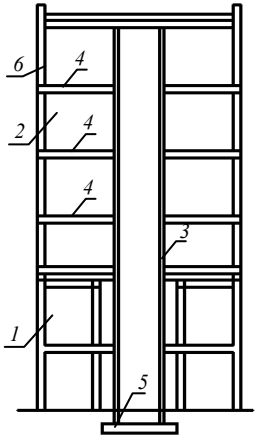
1 - existing building with longitudinal (cross) bearing walls;
2 - addition with bearing walls running in the direction different from the one in the existing building; *3* - chords of rigidity

THE ADDITION RESTS ON INDEPENDENT STRUCTURES OUTSIDE THE BUILDING



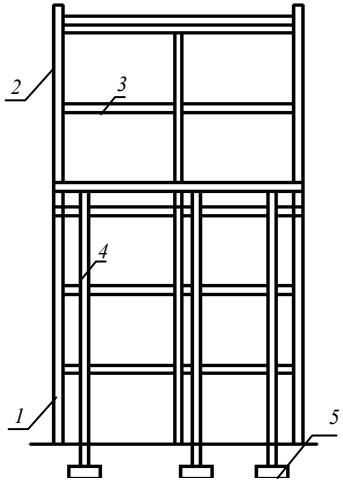
1 - existing building; *2* - addition resting on independent members outside the existing building; *3* - open-frame girders (beams-walls) of storeys to be added; *4* - columns of the addition; *5* - foundations of the addition

THE ADDITION RESTS ON REINFORCED CONCRETE CORE OF RIGIDITY



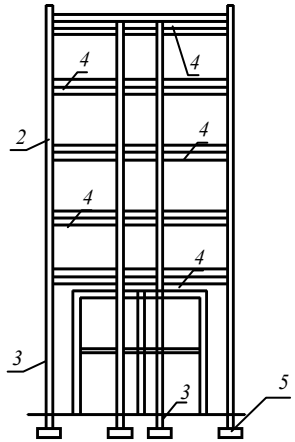
1 - existing building; *2* - addition resting on reinforced concrete core of rigidity inside the existing building; *3* - cast-in-place reinforced concrete core of rigidity; *4* - cast-in-place reinforced concrete floors; *5* - foundations of the addition; *6* - hinged panels of the addition

THE ADDITION RESTS ON INDEPENDENT MEMBERS INSIDE THE BUILDING



1 - existing building; *2* - addition resting on independent members inside the existing building; *3* - foundation platform of the addition (reinforced concrete ribbed slab); *4* - columns of the addition;
5 - foundations of the addition

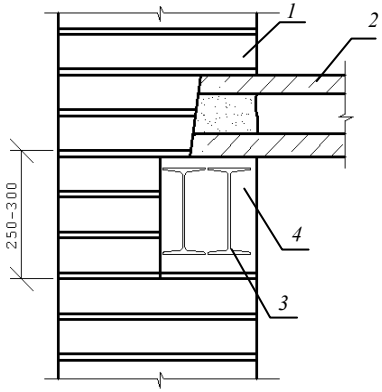
THE ADDITION RESTS ON INDEPENDENT MEMBERS OUTSIDE AND INSIDE THE BUILDING



1 - existing building; *2*- addition resting on independent members outside and inside the building; *3* - columns of the addition;
4 - precast beam or cast in-place reinforced concrete floors erected by usual method or by floor lifting method; *5* - foundations of the addition

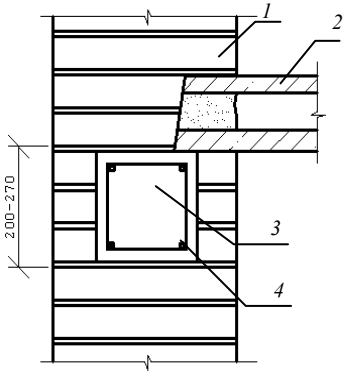
INCREASING THE BRICK WALL RIGIDITY IN HEIGHTENING THE BUILDING

SETTING OF ROLLED METAL BEAMS



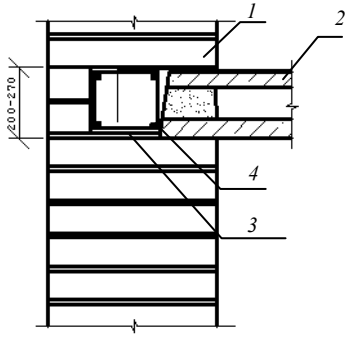
1 - wall of heightened storey; *2* - floor of heightened storey; *3* - rolled metal beams (channel, double-tee) along external and internal load-bearing walls (to be welded in intersections by means of cover plates); *4* - concrete

ARRANGEMENT OF REINFORCED CONCRETE CHORDS AT FLOOR BOTTOM LEVEL



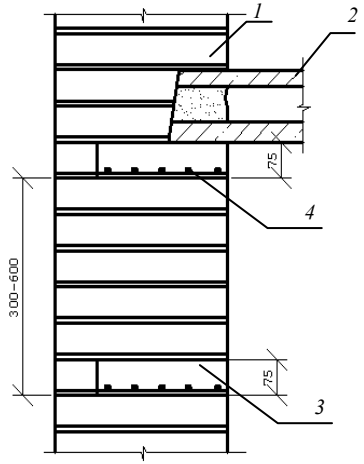
1 - wall of heightened storey; *2* - floor of heightened storey; *3* - reinforced concrete chord along external and internal wall perimeter (in wall intersections longitudinal einforcement is bent or additional Г-shaped rode are set); *4* - 16 to 32 mm diameter longitudinal reinforcing rods

ARRANGEMENT OF REINFORCED CONCRETE CHORDS AT A FLOOR LEVEL



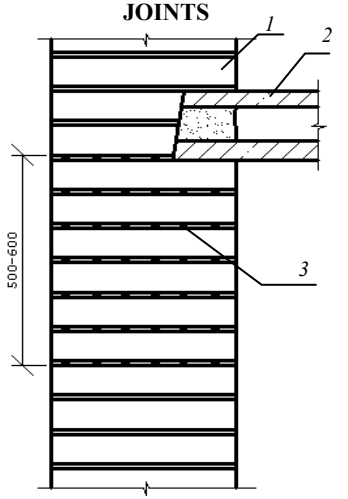
1-wall of heightened storey; *2*- floor of heightened storey; *3*- reinforced concrete chord along external and internal wall perimeter (in wall intersections longitudinal reinforcement is bent or additional Г-shaped rods are set); *4* - 16 to 32 mm diameter longitudinal reinforcing rods; *5* - 12 mm diameter reinforcing rods welded to erecting loops of floor slabs and brought into chord

ARRANGEMENT OF REINFORCED CONCRETE CHORDS AT FLOOR BOTTOM LEVEL



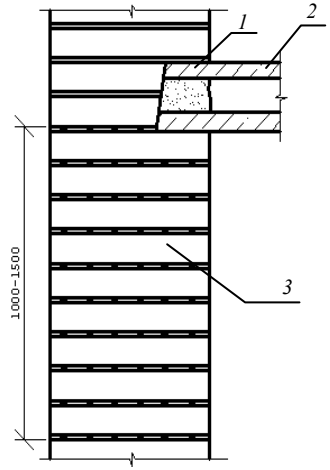
1 - wall of heightened storey; *2* - floor of heightened storey; *3* - reinforced concrete chord along external and internal wall perimeter (reinforcing fabrics are set overlap in wall intersections); *4* - reinforcing fabrics

PLACING OF REINFORCING RODS IN HORIZONTAL JOINTS



1 - wall of heightened storey; *2* - floor of heightened storey; *3* - 10 mm diameter reinforcing bars in horizontal joints along external and internal wall perimeter (reshaped rode are placed in wall intersections with one course alternation

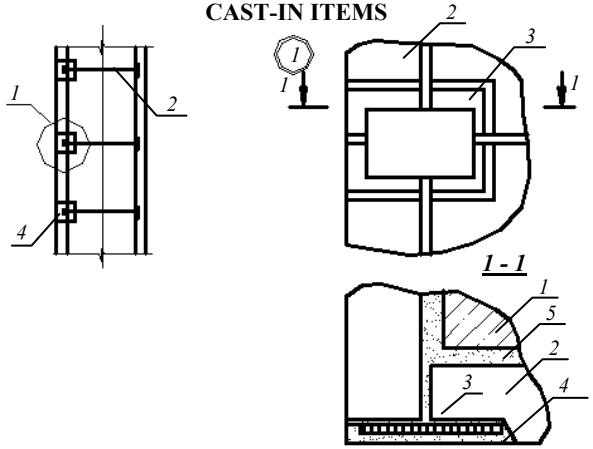
SETTING OF REINFORCING FABRICS IN HORIZONTAL JOINTS



1 - wall of heightened storey; *2* - floor of heightened storey; *3* - reinforcing fabrics in horizontal joints along external and internal load-bearing walls (T-shaped fabrics are set in wall intersections)

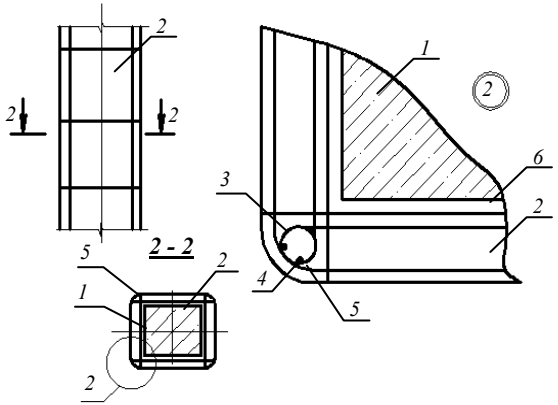
STRENGTHENING OF WALLS AND COLUMNS REINFORCED BY PRECAST REINFORCED CONCRETE YOKES

STRENGTHENING OF COLUMNS BY YOKES WHOSE SUBS ARE CONNECTED BY MEANS OF WELDING THE CAST-IN ITEMS



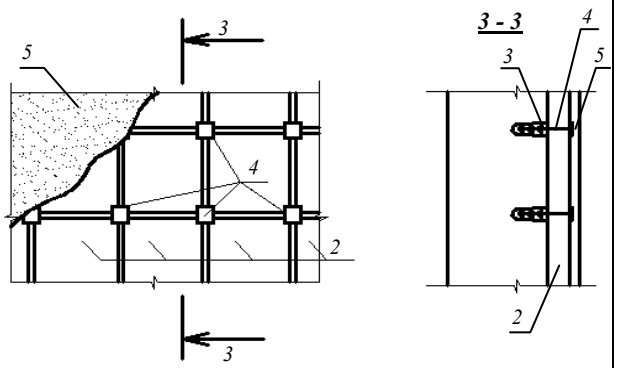
1 - column under strengthening; *2* - precast reinforced concrete slabs of yoke; *3* - cast-in items in yoke slabs; *4* - welded metal cover plate; *5* - cement-sand mortar

STRENGTHENING OF COLUMNS BY YOKES WHOSE SLABS ARE CONNECTED BY MEANS OF LOOPED PROTRUDING BARS



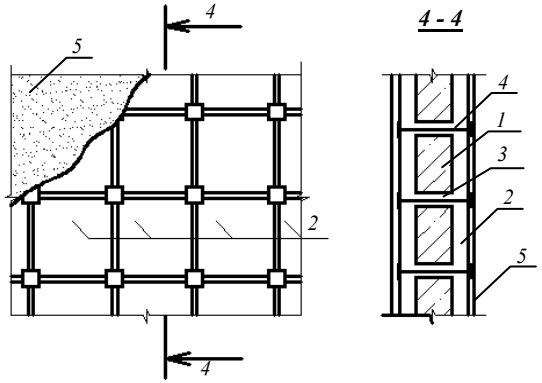
1 - column under strengthening; *2* - precast reinforced concrete slabs of yoke; *3*- looped bars protruding from slabs; *4* - vertical reinforcing rods; *5* - concreting of butt end; *6* - cement-sand mortar

STRENGTHENING OF BRICK WALLS



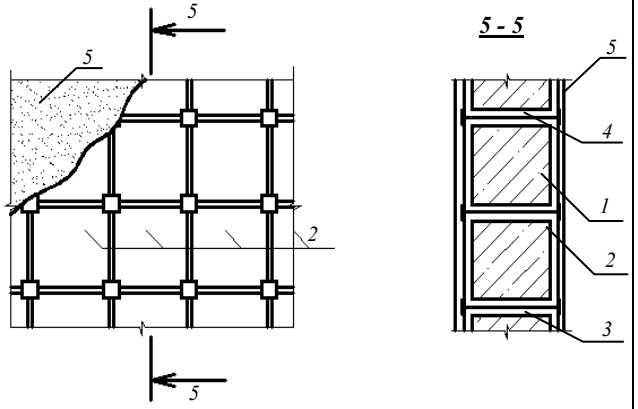
1 - brick wall under strengthening; *2* - precast slabs of yoke (reinforced concrete, expanded clay concrete and others placed on prepared wall surface by means of mortar); *3* - wooden brick set in drilled holes; *4* - anchor braces hammered into wooden brick; *5* - plaster

STRENGTHENING OF LARGE PANEL CONCRETE WALLS AND PARTITIONS



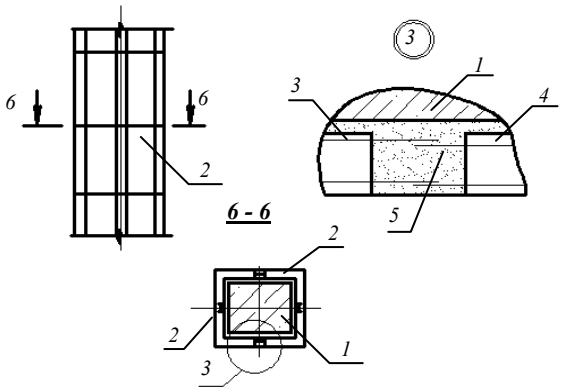
1 - concrete wall or partition under strengthening; *2* - yoke precast reinforced concrete slabs placed by means of mortar; *3* -holes drilled in the wall; *4* - anchor braces set in drilled holes; *5* - plaster

STRENGTHENING OF LARGE-BLOCK WALLS



1 - concrete block wall under strengthening; *2* - precast reinforced concrete slabs of yoke; *3* - horizontal joints between blocks; *4* -anchor braces set between blocks; *5* - plaster

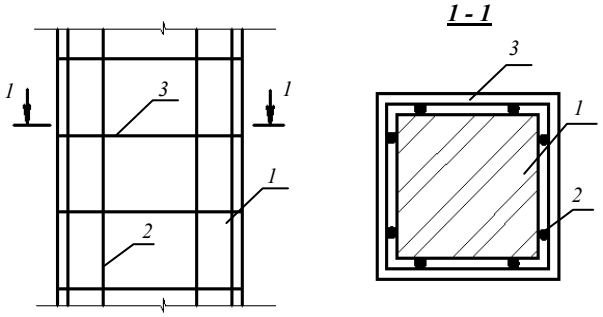
STRENGTHENING OF COLUMNS BY YOKES WHOSE SLABS ARE CONNECTED BY MEANS OF WELDING THE CAST-IN ITEMS



1 - column under strengthening; *2* - precast reinforced concrete angle slabs of yoke; *3* - reinforcing bars protruding from yoke slabs; *4* - welding of protruding bars; *5* - cement-sand mortar

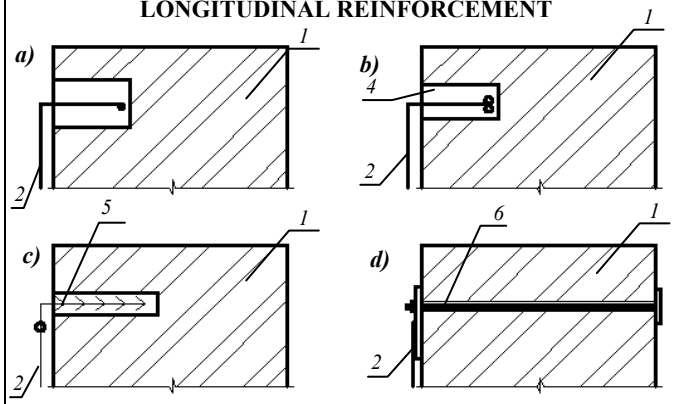
STRENGTHENING OF STONE STRUCTURES BY PLACING LONGITUDINAL REINFORCEMENT

PLACING OF LONGITUDINAL REINFORCEMENT ALONG POSTS AND PIERS PERIMETER



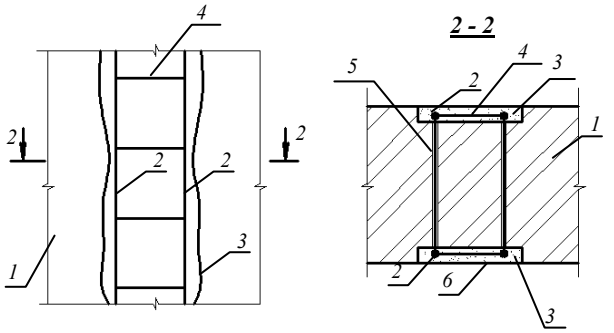
1 - member under strengthening (post, pier, etc.); *2*- strengthening longitudinal reinforcement anchored in upper and lower portions of strengthened member (by means of chords, keys, anchors, tension bars, etc.); *3* - lateral stirrups; *4* - cement-sand mortar plaster

WAYS OF ANCHORAGE OF STRENGTHENING LONGITUDINAL REINFORCEMENT



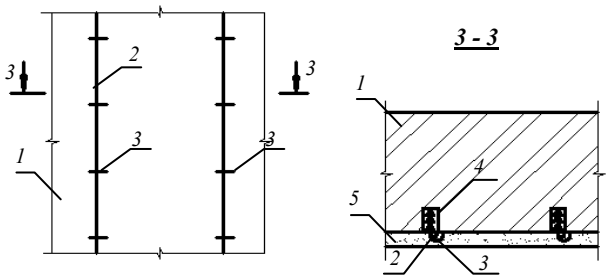
a - by means of reinforced concrete chords; *b* - by means of reinforced concrete keys; *c* - by means of anchors; *d* - by means of tension bars;
1 - upper (lower) portion of the member under strengthening; *2* - longitudinal reinforcement in the upper (lower) portion of the wall; *3* - reinforced concrete chord set in the joggle; *4* - reinforced concrete key set in out off pocket; *5* - reinforcing steel anchor set by means of concrete or mortar in bored hole; *6* - tension bar set in drilled wall hole

PLACING OF LONGITUDINAL REINFORCEMENT FROM BOTH SIDES OF JOGGLE WALLS



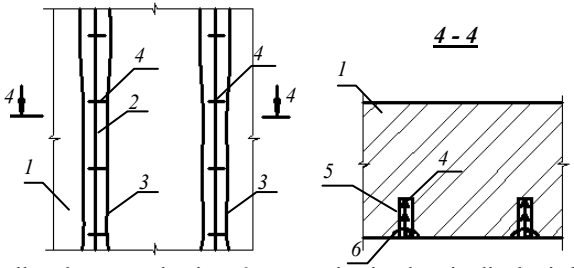
1 - wall under strengthening; *2* - strengthening longitudinal reinforcement anchored in upper and lower portions of the wall (by means of chords, keys, anchors, tension bars, etc.); *3* - joggle cut out in the wall for reinforcement; *4* - lateral stirrups passed through drilled wall holes; *5* - drilled wall holes for stirrups; *6* - cement-sand mortar plaster

PLACING OF LONGITUDINAL REINFORCEMENT FROM ONE SIDE OF THE WALLS



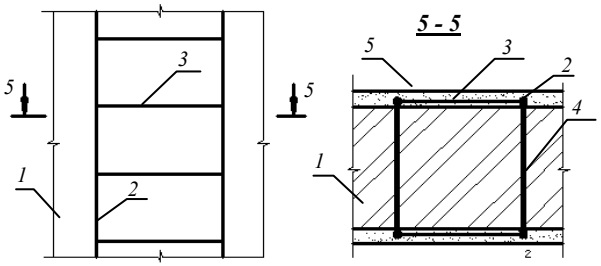
1 - wall under strengthening; *2* - strengthening longitudinal reinforcement anchored in upper and lower portions of the wall (by means of chords, keys, anchors, tension bars, etc.); *3* - anchors hammered into masonry joints or set on mortar in drilled holes (anchors should enclose longitudinal reinforcement or be welded to it); *4* - holes for anchors; *5* - cement-sand mortar plaster

PLACING OF LONGITUDINAL REINFORCEMENT PROM ONE SIDE OF JOGGLE WALLS



1 - wall under strengthening; *2* - strengthening longitudinal reinforcement anchored in upper and lower portions of the wall (by means of chords, keys, anchors, tension bars, etc.); *3* - joggle cut in the wall for placing longitudinal reinforcement; *4* - anchors hammered into masonry joints or set on mortar into drilled holes (anchors should enclose longitudinal reinforcement or be welded to it); *5* - drilled wall holes for setting the anchors; *6* - cement-sand mortar

PLACING OF LONGITUDINAL REINFORCEMENT FROM BOTH SIDES OF THE WALLS

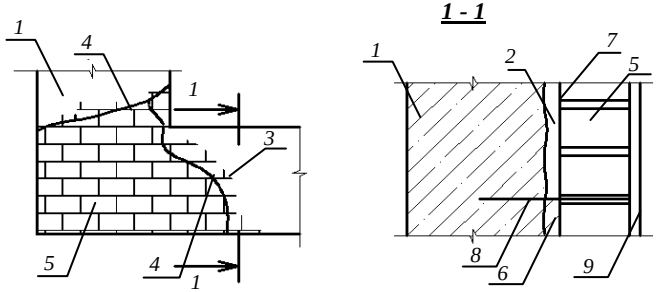


1 - wall under strengthening; *2* - strengthening longitudinal reinforcement anchored in upper and lower portions of the wall (by means of chords, keys, anchors, tension bars, etc.); *3* – lateral stirrups passed through drilled wall holes; *4* - holes for stirrups; *5* - cement-sand mortar plaster

WAYS OF STRENGTHENING LARGE-PANEL EXTERNAL WALLS

BRICK LAYING IN AREAS OF DEEP DESTRUCTION

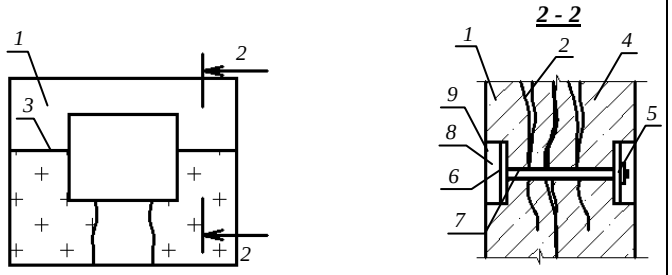
1 - 1



1 - panel under strengthening; *2* - section of panel destructed to a depth of more than 40 mm; *3* - failure boundary; *4* - failure boundary prepared for placing piece members; *5* - rectangular piece members; *6* - failure place: deepened, cleaned, air blasted and moistened; *7* - cement-lime mortar with expanded clay sand addition; *8* - galvanized nails hammered in panel at every 500 mm in chess order; *9* - protective-decorative covering

SETTING OF COUPLING BOLTS IN SEGREGATED AREAS OF PANEL

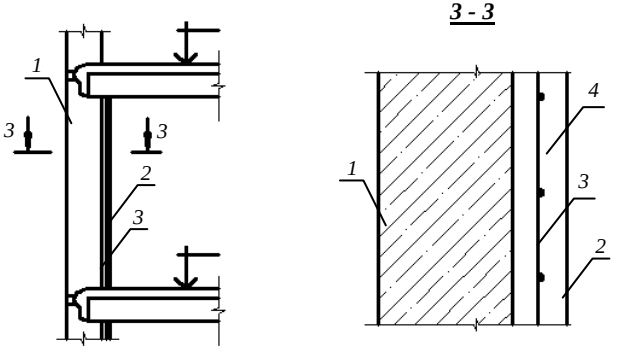
2 - 2



1 - panel under strengthening; *2* - cracks and scalings in panel; *3* - seal-ing boundary; *4* - coupling bolts spaced at 300 to 500 mm; *5* - nut; *6* - washers; *7* - holes in panel for coupling bolts; *8* - recesses in panel for washers; *9* - light weight concrete or porous mortar layer 20 mm thick

ERECTION OF CAST-IN-PLACE REINFORCED CONCRETE WALL FROM THE INSIDE

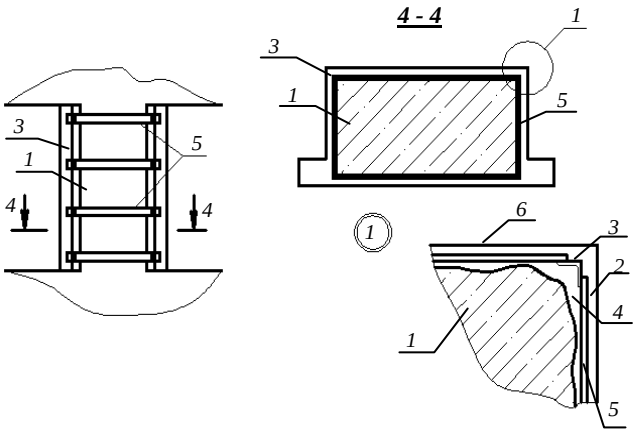
3 - 3



1- panel under strengthening; *2* - cast-in-place reinforced concrete wall not lees than 100 mm thick with support on foundation; *3* - reinforcing fabric; *4*-concrete

ERECTION OF STEEL FIXTURE FOR PIER

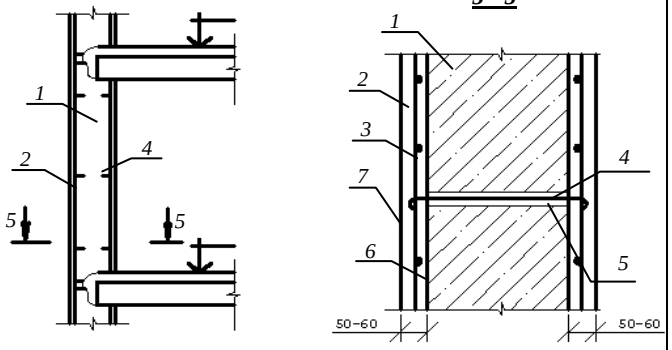
4 - 4



1 - panel pier under strengthening; *2* - vertical grooves in pier for fixing the angles; *3* - fixture angles; *4* - horizontal grooves for setting cross planks; *5* - 4 mm wide steel strip cross planks; *6* - grooves patched with porous expanded clay sand

ERRECTION OF CAST-IN-PLACE REINFORCED CONCRETE WALLS FROM TWO SIDES

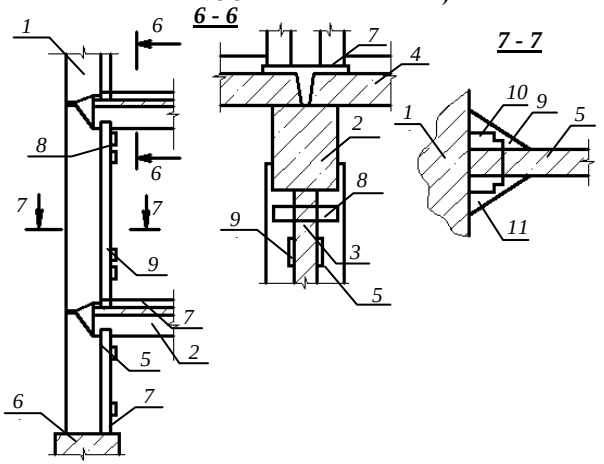
5 - 5



1 - panel under strengthening; *2* - cast-in- place reinforced concrete wall from 50 to 60 mm thick; *3* - reinforcing fabric; *4* - reinforcement braces set in drilled holes; *5* - chess ordered holes spaced at 1.0 m; *6* - panel surface prepared for concreting (cleandowned, hacked); *7* - fine grained concrete

POSITIONING OF ATTACHED RELIEVING COLUMNS UNDER GIRDER (IN BUILDINGS WITH INCOMPLETE FRAME)

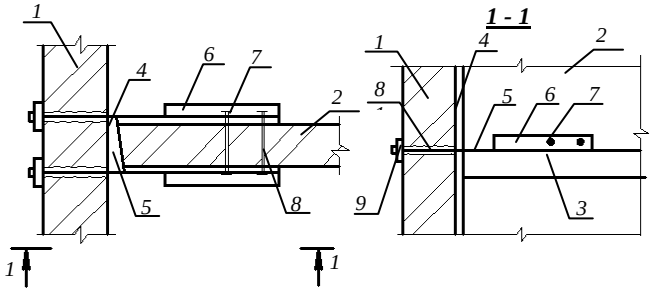
6 - 6 **7 - 7**



1 - panel under strengthening; *2* - girder; *3* - internal panel; *4* - floor slabs; *5* - attached relieving column; *6* - foundation; *7* - column bearing base; *8* - connecting planks; *9* - ribs-spacers; *10* - expended clay concrete; *11* - plaster

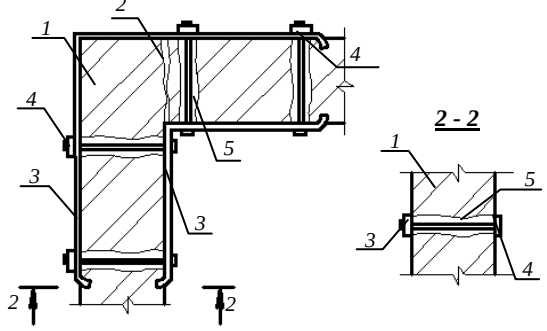
STRENGTHENING OF BRICK WALL CONNECTION JOINTS

CONNECTION OF EXTERNAL AND INTERNAL WALLS BY MEANS OF TENSION BARS



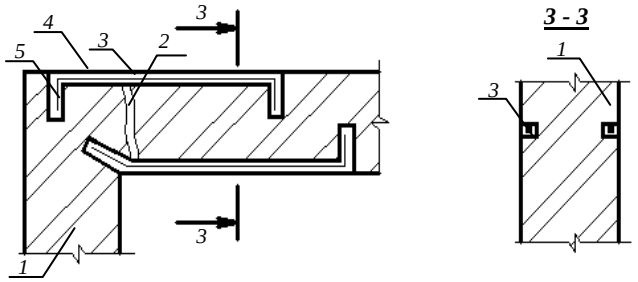
1 - external wall; *2* - internal wall; *3* - floor; *4* - crack in the wall joint (to be filled with mortar); *5* - tension bars welded to angles; *6* -metal angles;*7* - bolts; *8* - holes in the wall (to be filled with cement-sand mortar after tension bars fixing); *9* - tension nuts

CONNECTION OF EXTERNAL CORNER WALLS BY MEANS OF METAL COVER PLATES



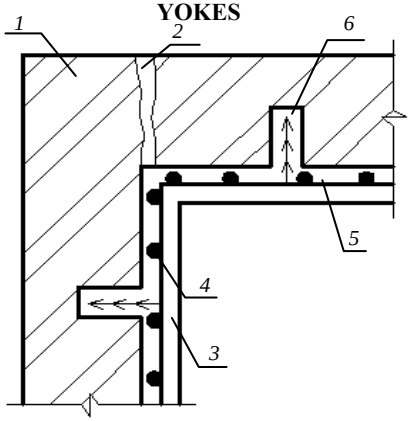
1 - external corner walls; *2* - crack in the wall joint (to bee filled with mortar); *3* - double-sided metal strip cover plates spaced at 500 mm in height; *4* - coupling bolts; *5* - holes drilled in the wall (to be filled with mortar after bolts fixing)

CONNECTION OF EXTERNAL CORNER WALLS BY MEANS OF STEEL BRACES



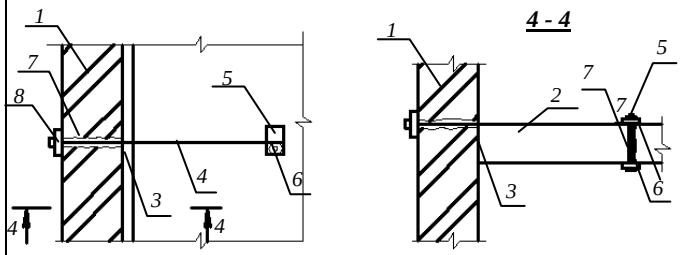
1 - external corner walls; *2* - crack in the wall joint(to be filled with mortar); *3* - 10 to 12 mm diameter periodical profile reinforcement metal braces placed on mortar; *4* - 15 to 20 mm wide grooves milled in masonry to the depth of 35 to 40 mm; *5* - 15 to 20 mm diameter, 100mm deep holes drilled at groove ends

CONNECTION OF EXTERNAL CORNER WALLS BY MEANS OF REINFORCED CONCRETE OR PLASTER YOKES



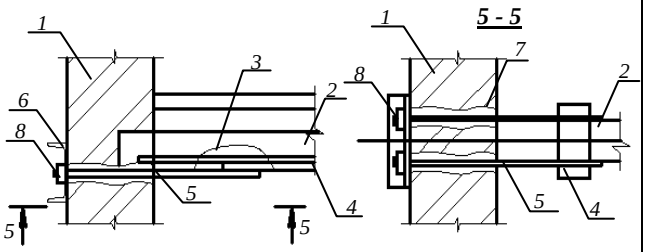
1 - external corner walls; *2* - crack in the wall joint (to be filled with mortar); *3* - plaster or reinforced concrete yoke; *4* – reinforcing fabric; *5* - 10 mm diameter periodical profile reinforcement anchors spaced at 600 to 800 mm horizontally and vertically, set by means of mortar; *6* - holes drilled in walls to the depth of no less than 100 mm

CONNECTION OF EXTERNAL WALLS WITH FLOOR SLABS BY MEANS OF TENSION BARS



1 - external wall; *2* - reinforced concrete floor; *3* - crack between wall and floor (to be filled with mortar); *4* - tension bars welded to plates; *5* - metal plates; *6* - bolts; *7* - holes in walls and floor (to be filled with cement-sand mortar after tension bars and bolts fixing); *8* - tension nuts

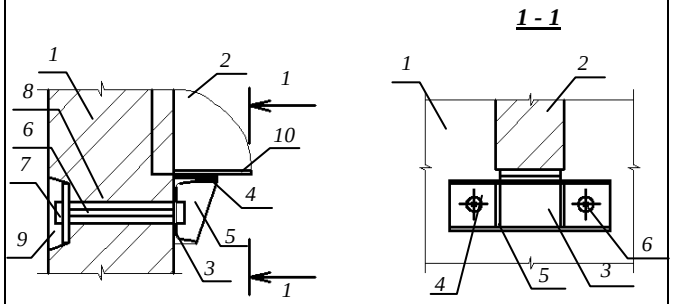
CONNECTION OF EXTERNAL WALLS WITH FLOOR BEAMS BY MEANS OF TENSION BARS



1 - external walls; *2* - reinforced concrete floor beam; *3* - exposed principle reinforcement of beam; *4* - plate welded to exposed reinforcement of beam; *5* - tension bars welded to plates; *6* - pad-washer for strengthening the tension bars; *7* - holes in the wall for tension bars (to be filled with cement-sand mortar after tension bars fixing); *8* - tension nuts

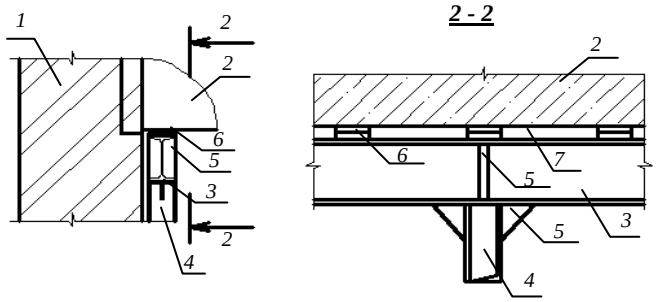
STRENGTHENING OF BEAM AND SLAB-TO-BRICK WALL CONNECTION JOINTS

FIXING OF METAL PROPS



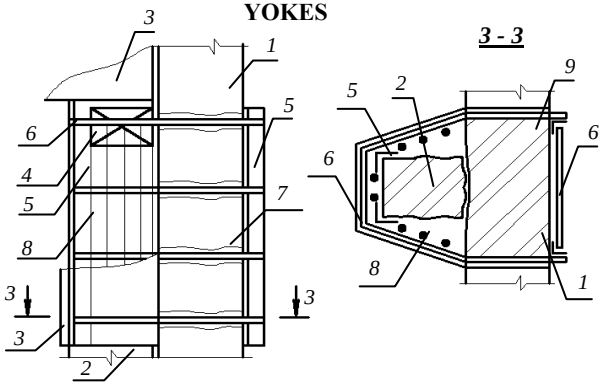
1 - wall; *2* - bearing beam without sufficient support on the wall; *3* - channel supporting prop; *4* - additional plate; *5* - stiffening ribs; *6* - anchor bolts; *7* - plates-washers; *8* - holes in the wall (to be filled with cement-sand mortar after fastening the bolts); *9* - recess in the wall (to be filled with mortar); *10* - metal plate-wedges for engaging props into the joint work

POSITIONING OF BEAMS BY MEANS OF POSTS



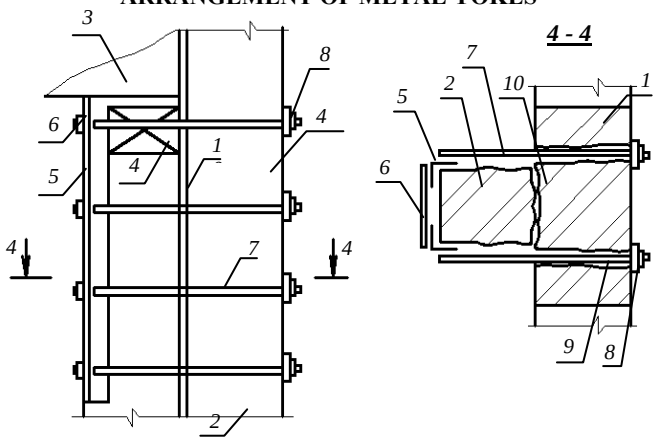
1 - wall; *2* - floor without sufficient support on the wall; *3* - N12-20 double-tee beam support; *4* - posts (tube, angle or channel box sections spaced at 1.5-3 m); *5* - stiffening ribs; *6* - plate-wedges spaced at 300 to 500 mm for engaging beams into the joint work; *7* - joint (to be caulked by cement-sand mortar after lining the plate-wedges)

ARRANGEMENT OF REINFORCED CONCRETE YOKES



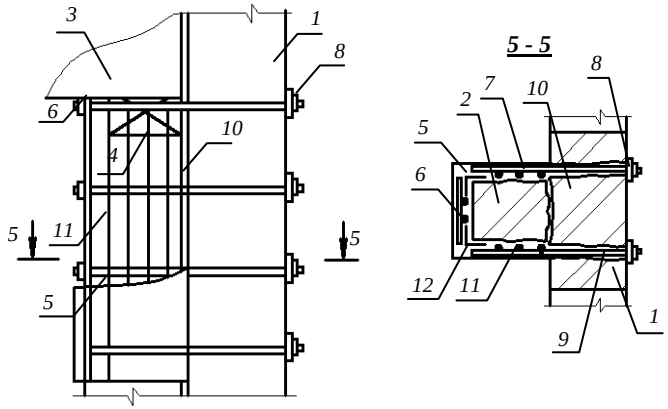
1 - pier; *2* - pilaster; *3* - bearing beam; *4* - supporting pad; *5* - yoke angles; *6* - lateral reinforcement planks-yokes; *7* - grooves on pier side surface (to be caulked with cement-sand mortar after fixing the cross planks); *8* - additional reinforcement; *9* - yoke concrete; *10* - crack in pilaster-to-pier connection zone (to be filled with mortar)

ARRANGEMENT OF METAL YOKES



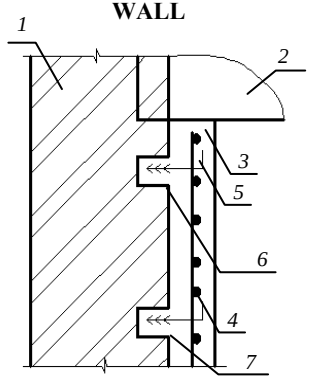
1- pier; *2* - plaster; *3* - bearing beam; *4* - supporting pad; *5* - yoke angles; *6* - lateral reinforcement planks-yokes; *7* - lateral planks-tension bars with nuts; *8* - washers; *9* - holes in the wall (to be filled with cement-sand mortar after fixing the tension bars); *10* - crack in pilaster-to-pier connection zone (to be filled with mortar)

ARRANGEMENT OF REINFORCED CONCRETE YOKES



1 - pier; *2* - plaster; *3* - bearing beam; *4* - supporting pad; *5* - yoke angles; *6* - lateral reinforcement planks-yokes; *7* - lateral planks-tension bars with nuts; *8* - washers; *9* - holes in the wall (to be filled with cement-sand mortar after fixing the tension bars); *10* - crack in pilaster-to-pier connection zone (to be filled with mortar); *11* - additional reinforcement; *12* - yoke concrete

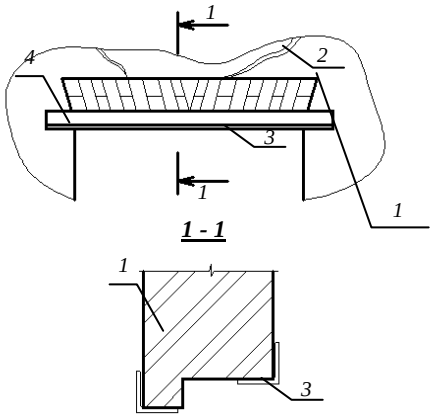
ARRANGEMENT OF REINFORCED CONCRETE WALL



1 - wall; *2* - floor without sufficient support on the wall; *3* - reinforced concrete wall; *4* - reinforcing fabric; *5* - 10mm diameter periodical profile reinforcement anchors placed on mortar in drilled holes; *6* - 15 mm diameter holes drilled in masonry at a depth of 100 mm (spaced at 700 to 1000 mm horizontally and vertically); *7* - wall surface prepared for concreting (cleared from plaster and washed)

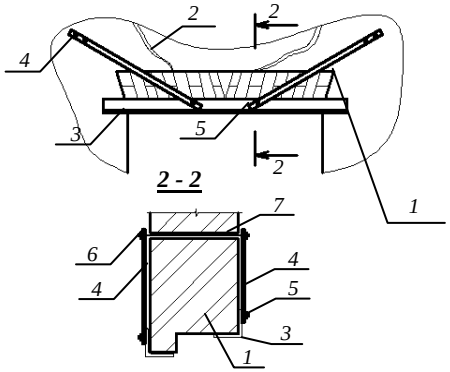
STRENGTHENING OF BRICK LINTELS

SETTING OF ANGLE COVER PLATES



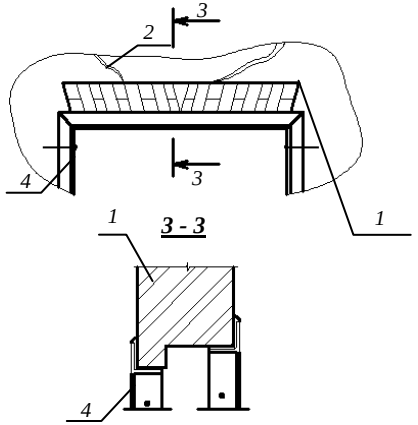
1 - lintel under strengthening; *2* - cracks is the lintel; *3* - angle cover plates placed on cement-sand mortar; *4* - cover plates embedded into the wall

SETTING OF ANGLE COVER PLATES WITH ADDITIONAL FASTENING BY MEANS OF TENSION BARS



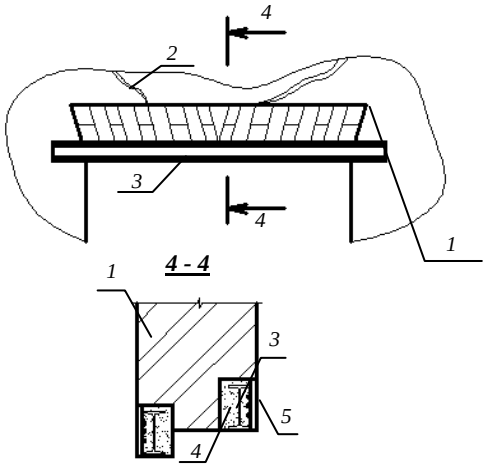
1 - lintel under strengthening; *2* - cracks in the lintel; *3* - angle cover plates placed on cement-sand mortar; *4* - strip steel tension bare; *5* - fastening bolts; *6* - anchor bolts; *7* - holes in the wall (to be caulked by mortar after fastening the bolts)

FITTING OF COVER PLATES BY MEANS OF POSTS



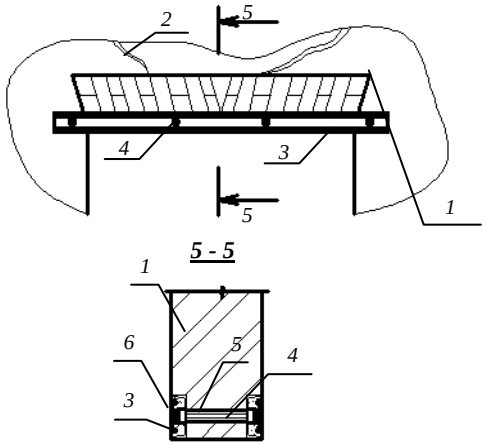
1 - lintel under strengthening; *2* - cracks in the lintels; *3* - angle cover plates placed on cement-sand mortar; *4* - angle posts; *5* - anchor for fastening the posts; *6* - welding

SETTING OF METAL OR REINFORCED CONCRETE BEAMS



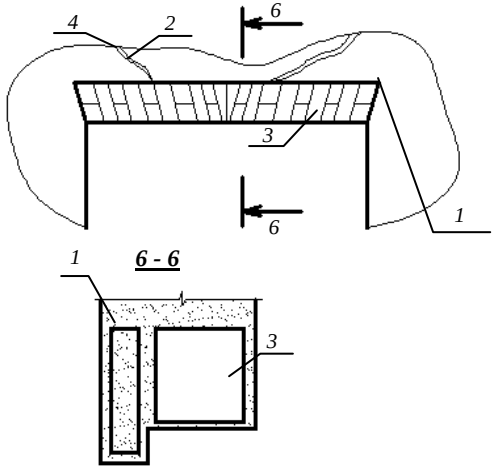
1 - lintel under strengthening; *2* - cracks in the lintel; *3* - strengthening double-tee or reinforced concrete beams; *4* - cement-sand mortar; *5* - plastering on mesh

FITTING OF COVER PLATES BY MEANS OF COUPLING BOLTS



1 - lintel under strengthening; *2* - cracks in the lintel; *3* - channel cover plates; *4* - coupling bolts; *5* - holes in the wall (to be caulked by mortar after fastening the bolts); *6* - plastering on mesh

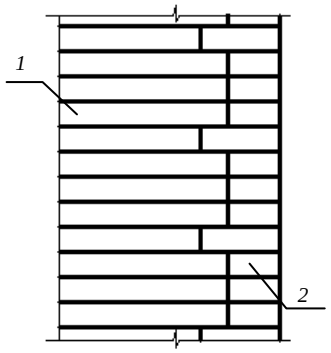
WEDGING OUT OF CRACKS BY METAL PLATES AND THEIR COUPLINGS



1- lintel under strengthening; *2* - cracks in the lintel; *3* - metal plate-wedges driven into cracks; *4* - cavities and cracks filled with cement-sand mortar

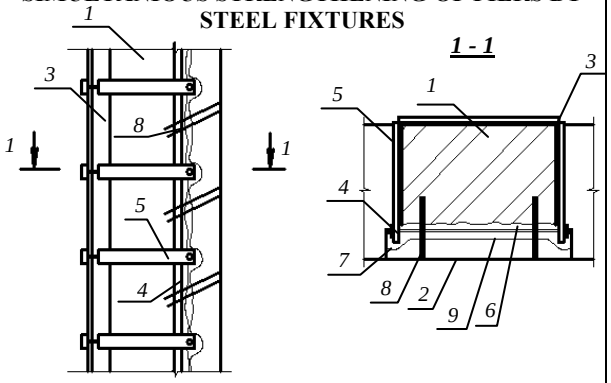
STRENGTHENING AND RECOVERING OF BRICK WALL FACING

REPLACEMENT OF DAMAGED FACING BY MEANS OF BOND WITH THE EXISTING MASONRY



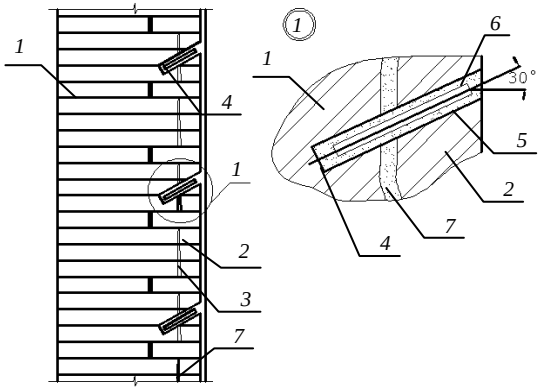
1 - wall masonry; *2* - nets facing bound with the existing wall masonry (the existing facing scaled from masonry more than 20mm is removed)

ATTACHMENT OF DAMAGED FACING WITH SIMULTANIOUS STRENGTHENING OF PIERS BY STEEL FIXTURES



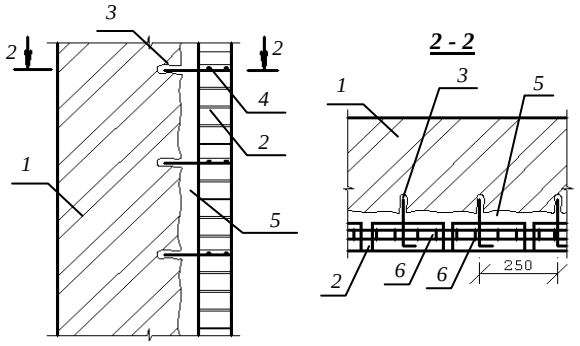
1 - pier masonry; *2* - facing; *3* - angle fixture posts; *4* - strip fixture posts; *5* - cross planks; *6* - cross planks in the form of tension bars in joints between facing and wall masonry ; *7* - spalling of "quarters" for bolts; *8* - steel ties for attaching the facing spaced at 600 to 800 mm horizontally and vertically; *9* - cavities filled with mortar

ATTACHMENT OF DAMAGED FACING BY USING STEEL TIES



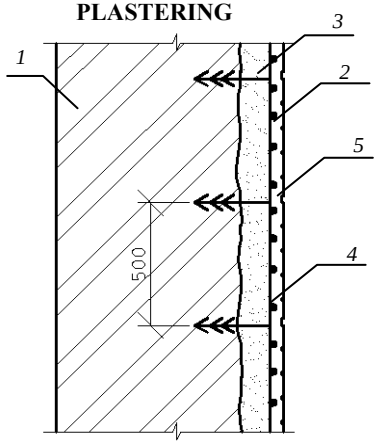
1 - wall masonry; *2* - damaged facing half a brick thick (scaled from masonry up to20 mm); *3* - clearance between masonry and facing; *4* - 20-40 mm diameter holes drilled to the depth of 350-400 mm and spaced at 600-800 mm horizontally and vertically; *5* - 10-14 mm diameter periodical profile tie-rod 300-500 mm long; *6* - cement-sand paste; *7* - injection by cement-sand mortar (in 7 days after ties fixing)

RESTORING OF EXTERNAL WALL DAMAGED SECTIONS BY ARRANGING THE FACING ON STEEL TIES



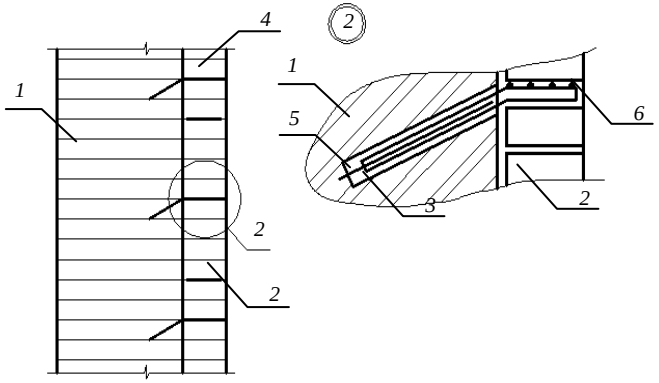
1 - wall masonry; *2* - new facing half a brick thick; *3* - periodical profile anchor rods placed on mortar in drilled holes; *4* -reinforcing fabrics set in horizontal joints at every sixth masonry course; *5* - cavity between old masonry and facing filled with cement sand mortar

RESTORING OF DAMAGED FACING BY PLASTERING



1 - wall masonry; *2* - cement- sand plaster; *3* - metal ties (rag bolts) driven in wall masonry joints at a space of 500 am vertically and horizontally; *4* - reinforcing fabric bound to metal ties; *5* - rustics imitating brick masonry joints

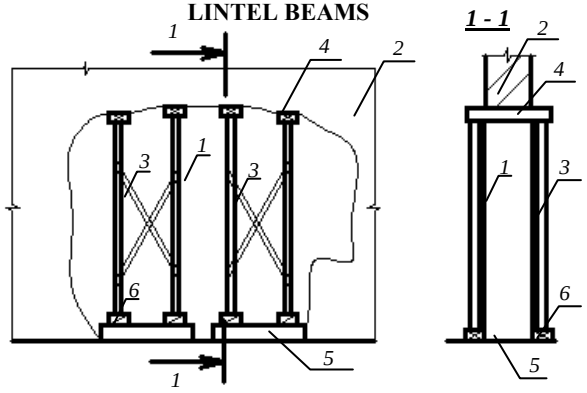
REPLACEMENT OF DAMAGED FACING BY ITS ATTACHMENT TO THE EXISTING MASONRY WITH THE HELP OF STEEL TIES



1 - wall masonry; *2* - new facing (the old facing scaled from masonry more than 20 mm is removed); *3* - 20-30 mm diameter holes drilled to the depth of 250-300 mm and spaced at 500 mm vertically and 1000 mm horizontally; *4* - 10-14 mm diameter periodical profile rod ties 350-400 mm long; *5* - cement-sand paste; *6* - reinforcing fabric in horizontal joints

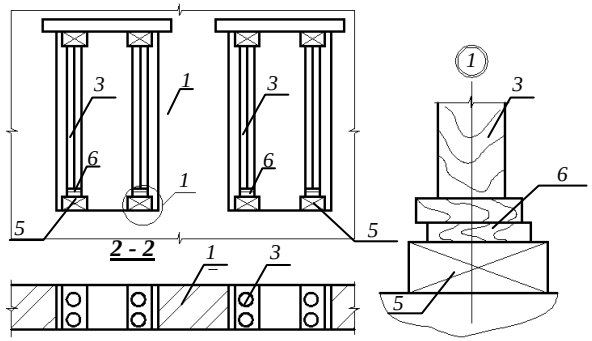
STRENGTHENING OF BRICK POSTS AND PIERS

SETTING OF WOODEN RELIEVING POSTS UNDER LINTEL BEAMS



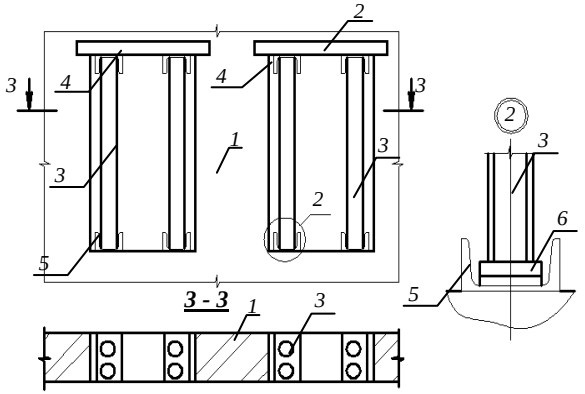
1 - collapsed wall masonry; *2* - overlieing wall masonry; *3* - relieving posts; *4* - square-sawn timber pad; *5* - square-sawn timber beams; *6* - wooden wedges

SETTING OF WOODEN RELIEVING POSTS UNDER LINTEL BEAMS



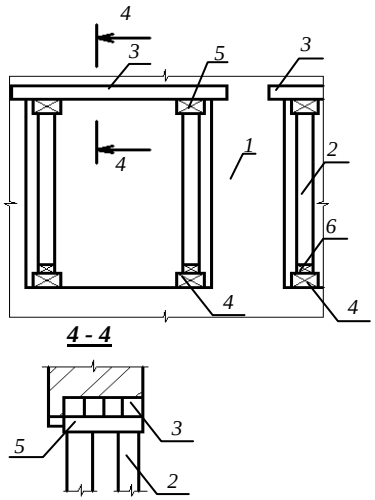
1 - pier to be relieved; *2* - lintel beam; *3* - relieving wooden post; *4* - square-sawn timber pad; *5* - square-sawn timber ground beam; *6* - oncoming wooden wedges for engaging the posts into work

SETTING OF METAL RELIEVING POSTS UNDER LINTEL BEAMS



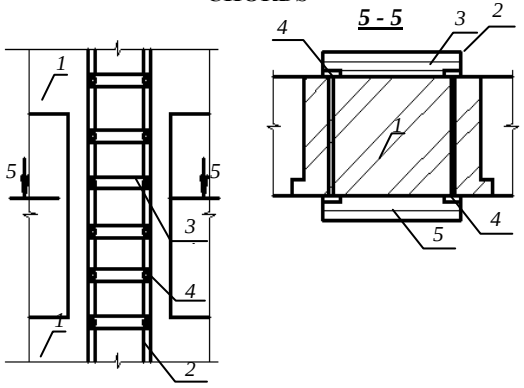
1 - pier to be strengthened; *2* - lintel beam; *3* - relieving metal post (tube, channel or angle box); *4* - channel pad; *5* - channel ground beam; *6* - oncoming metal plates-wedges

UNLOADING WITH REPLACEMENT OF PIER (POST) TO FOLLOW



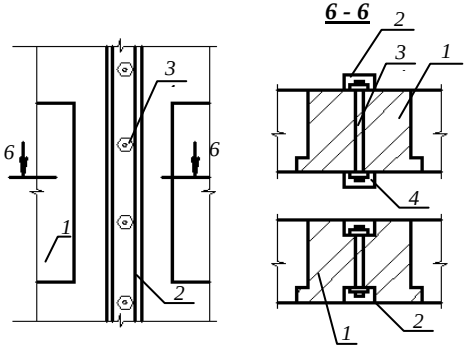
1- pier (post) under strengthening; *2* - relieving posts; *3* - reinforced concrete lintels; *4* - ground beam; *5* - pad; *6* - wedges

ARRANGEMENT OF ANGLE OVERLAPPING CHORDS



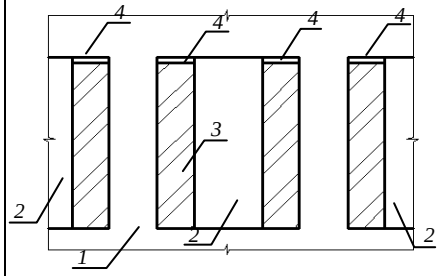
1- pier under strengthening; *2* - angles of overlapping chords; *3* - cross planks; *4* - coupling bolts; *5* - cement-sand plastering on metal mesh

ARRANGEMENT OF CHANNEL OVERLAPPING CHORDS



1 - pier under strengthening; *2* - channel overlapping chord; *3* - coupling bolts; *4* - cement-sand plastering on mesh

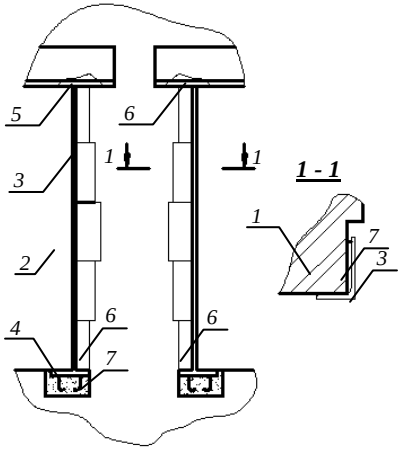
PARTIAL OR FULL BRICK FILLING OF OPENINGS



1 - piers under strengthening; *2* - window openings; *3* - M75-100 brick masonry on H50-75 brand mortar; *4* - joint wedged out by metal plates and caulked by cement-sand mortar

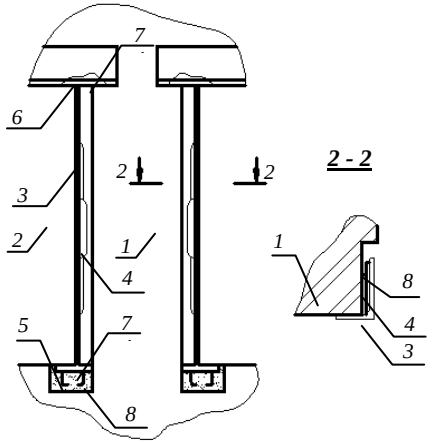
STRENGTHENING OF BRICK PIERS

POSITIONING OF COMPOSITE POSTS OF DIFFERENT SECTION ANGLES



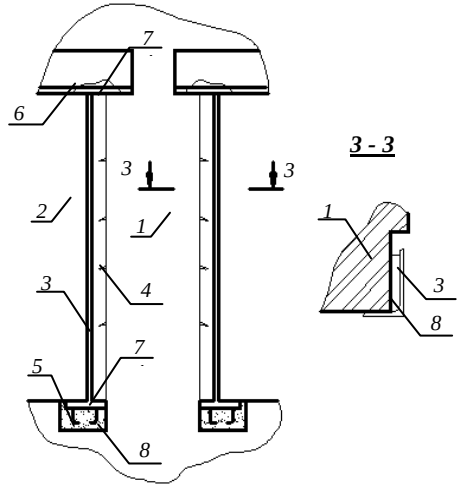
1 - pier under strengthening; *2* - openings; *3* - posts made of separate metal butt welded unequisided angles (gravity centre of the sections to follow is displaced to the pier); *4* - cast-in item; *5* - exposed reinforcement of lintel; *6* - welding; *7* - mortar

POSITIONING OF ANGLE POSTS WITH WELDED PLANKS



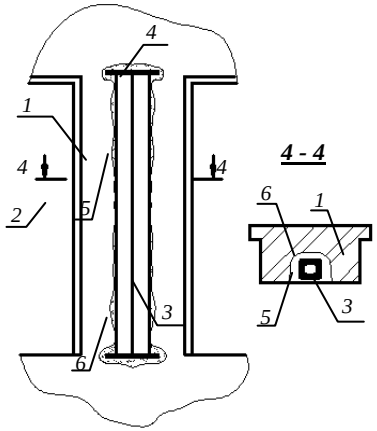
1 - pier under strengthening; *2* - openings; *3* - unequisided angle posts; *4* - planks welded to angles (plank thickness increases from ends to centre); *5* - cast-in item; *6* - exposed reinforcement of lintels; *7* - welding; *8* - mortar

POSITIONING OF ANGLE FRACTURED POSTS



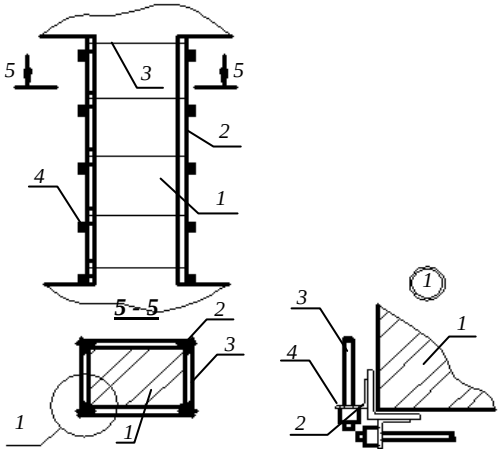
1 - pier under strengthening; *2* - openings; *3* - unequisided angle posts bent in the direction of pier; *4* - fracture lines (cuts) with sub- sequent wel-ding of slot; *5* - cast-in item; *6* - exposed reinforcement of lintels; *7* - welding; *8* - mortar

ARRANGEMENT OF METAL PROFILE MANDREL



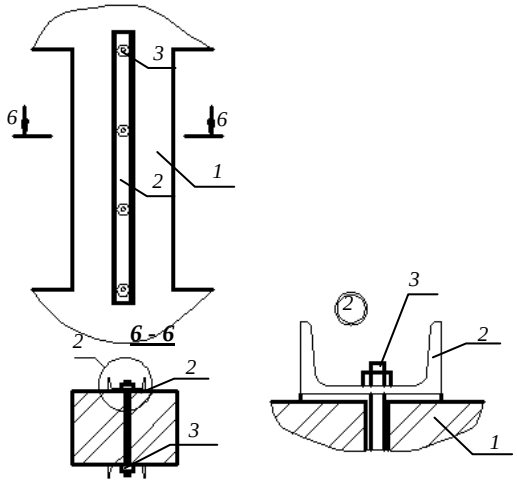
1- pier under Strengthening; *2* - openings; *3* - metal profile post (mandrel); *4* - metal plates (post base); *5* - recess cut out in the pier; *6* - cavities caulked by cement-sand

SETTING OF READY-MADE METAL YOKE



1 - pier to be strengthened; *2* - yoke angles; *3* - lateral stirrupsten-sion bars; *4* - angles-short rods welded to yoke angle for fixing the stirrups-tension bars

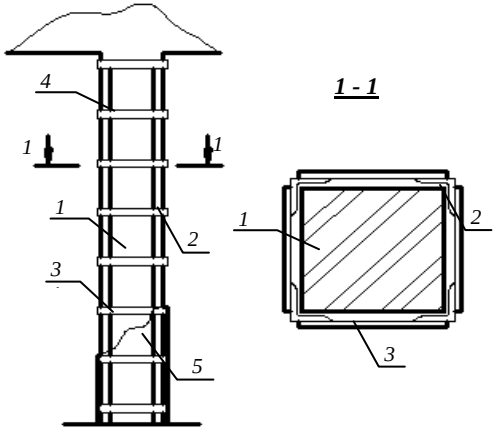
SETTING OF SUPERIMPOSED PLATES



1- pier to be strengthened; *2* - superimposed channel plate; *3* - tension bars set in holes drilled in pier

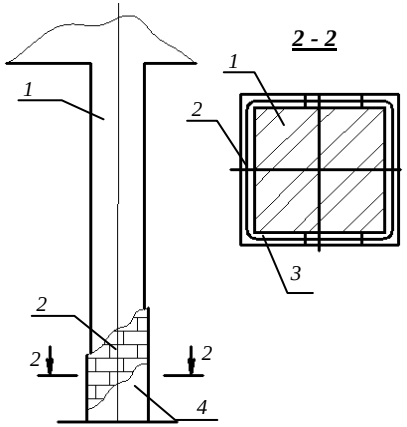
WAYS OF TEMPORARY STRENGTHENING THE BRICK WALL PIERS

ARRANGEMENT OF STEEL YOKE



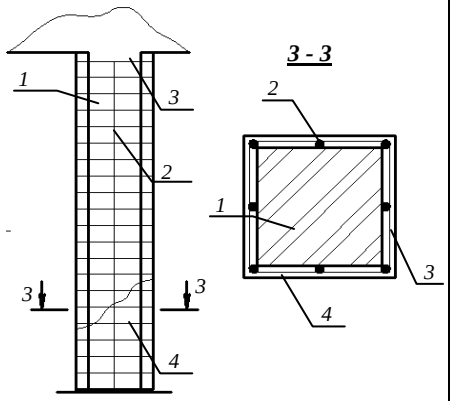
1 - post (pier) under strengthening; *2* - yoke angles; *3* - cross planks of yoke; *4* - welding; *5* - cement-sand mortar plastering

ARRANGEMENT OF BRICK YOKE



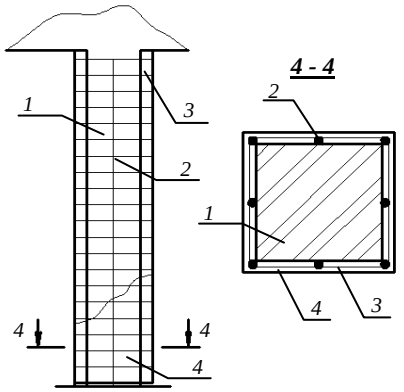
1 - post (pier) under strengthening; *2* - brick yoke of brick laid on rib; *3* - 5 to 10 mm diameter closed stirrups in each horizontal joint of yoke; *4* - plaster

ARRANGEMENT OF REINFORCED CONCRETE



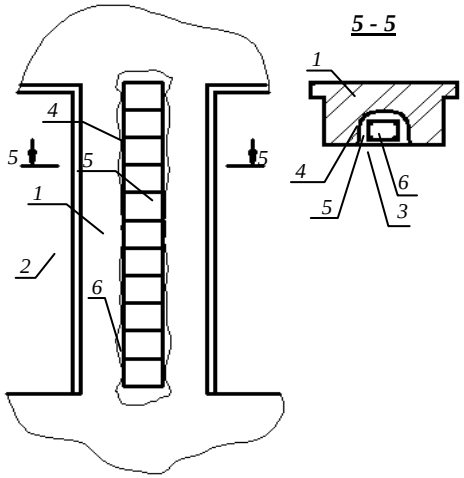
1 - post (pier) under strengthening; *2* - 6 to 12 mm diameter rods; *3* - 5 to 10 mm diameter stirrups; *4* - B15 class concrete

ARRANGEMENT OF REINFORCED MORTAR YOKE



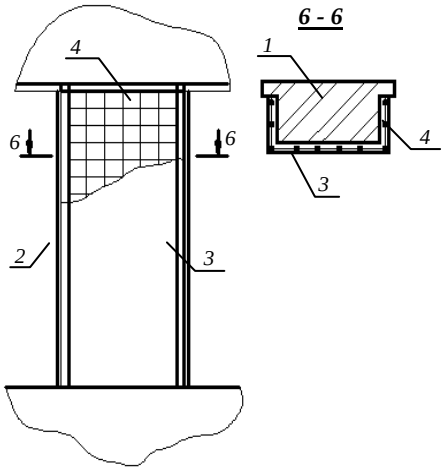
1 - post (pier) under strengthening; *2* - 6 to 12 mm diameter rods; *3* - 3 to 16 mm diameter stirrups; *4* - 75-100 brand mortar

ARRANGEMENT OF REINFORCED CONCRETE MANDREL



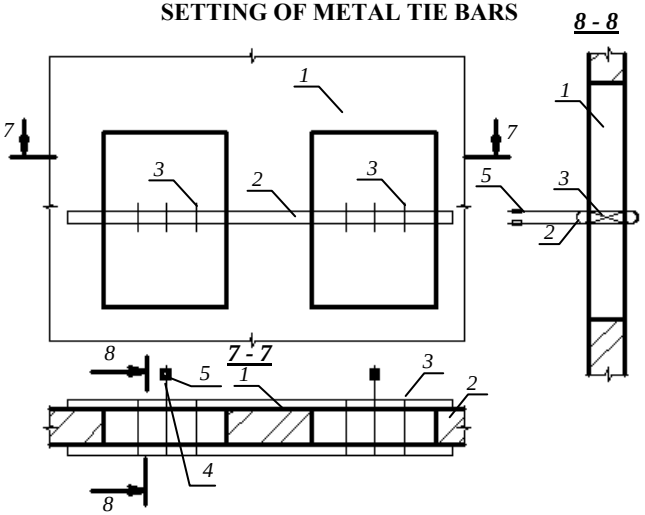
1 - pier under strengthening; *2* - openings; *3* - reinforced concrete post (mandrel); *4* - recess cut out in the pier; *5* - reinforcing cage; *6* - concrete

ARRANGEMENT OF REINFORCED CONCRETE JACKET



1- pier under strengthening; *2* - openings; *3* - 30 to 40 mm thick plaster jacket or 60 to 100 mm thick reinforced concrete jacket; *4* - 5 to 10 mm

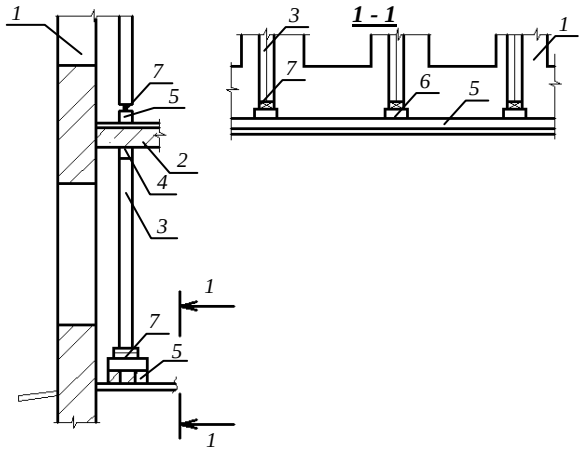
SETTING OF METAL TIE BARS



1 - bulging or displacing pier; *2* - log, square-sawn timber or rolled metal cross beam; *3* - 5 mm diameter wire snap ties; *4* - 16 to 20 mm diameter reinforcement guy (to be fastened to opposite piers or to internal walls); *5* - tension couplings

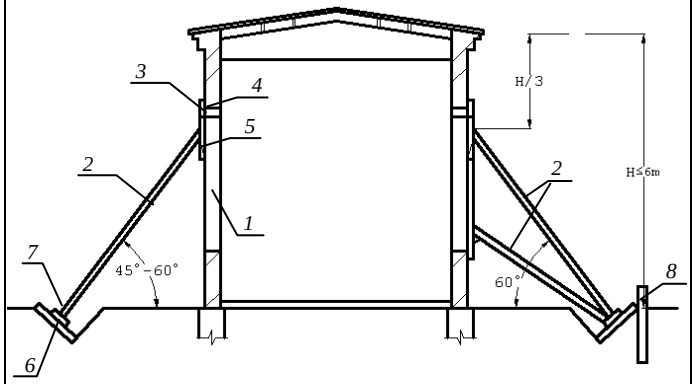
WAYS OF TEMPORARY STRENGTHENING THE BRICK WALLS

SETTING OF RELIEVING POSTS UNDER FLOORS



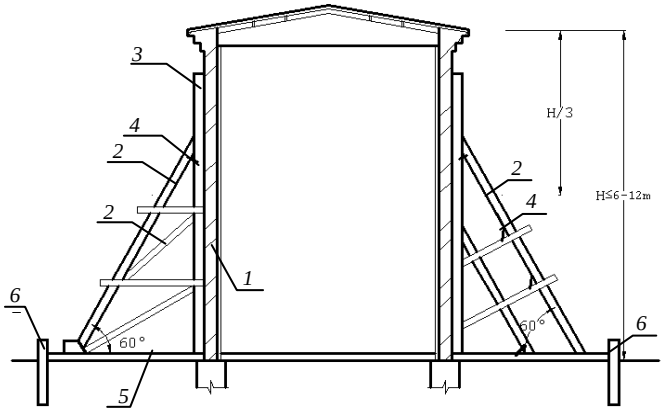
1 - pier to be strengthened; *2* - floor; *3* - relieving wooden posts; *4* - square-sawn timber pad; *5* - square-sawn timber ground beam; *6* - distribution square-sawn timber pad; *7* - wooden wedges for engaging the posts into work

SETTING OF SUB-STRUTS



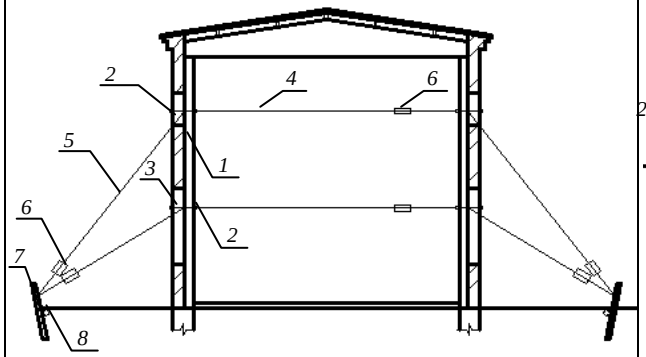
1 - load-bearing walls to be strengthened; *2*- log or square-sawn timber sub-struts; *3* - log or square-sawn timber pads; *4* - snap ties for attaching pads to walls; *5* - ledgers in the form of braces; *6* - pads under sub-struts; *7* - wooden wedges for engaging sub-struts into work; *8* - support in the form of log or square-sawn timber post

SETTING OF DOUBLE SUB-STRUTS



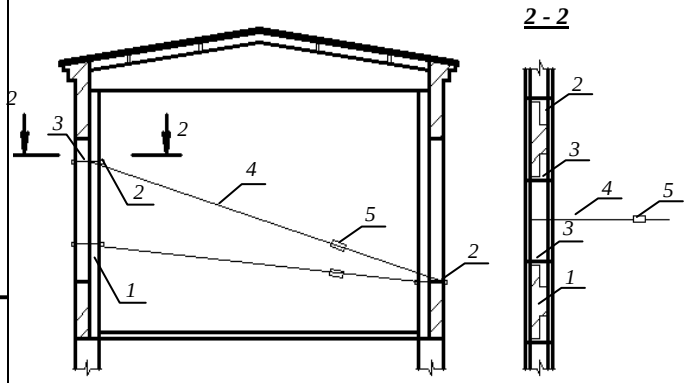
1 - load-bearing walls to be strengthened; *2* - log or square-sawn timber sub-strata; *3* - log or square-sawn timber poet; *4* - ledgers in the form of braces; *5* - log or square-sawn timber ground beam; *6* - support in the form of log or square-sawn timber post

SETTING OF STEEL BRACES



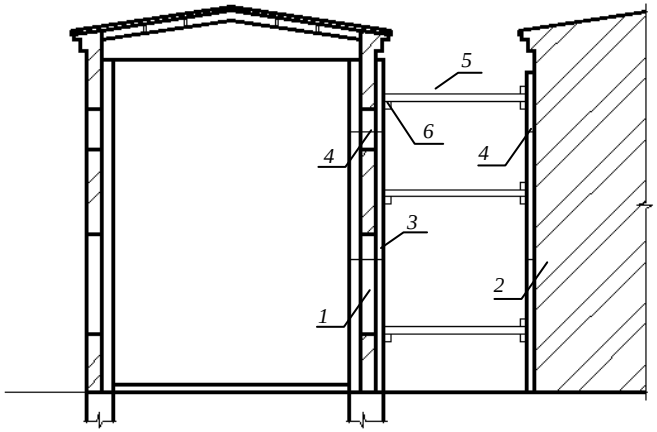
1 - strengthened load-bearing wall with pilasters; *2* - log or square-sawn timber traverse; *3* - tie bars in the form of tension bars or snap ties; *4* - reinforcing steel ties; *5* - reinforcing steel braces; *6* - turnbuckles; *7* - anchor in the form of logged or square-sawn timber post; *8* - log or square-sawn timber stop

SETTING OF STEEL GUYS



1 - strengthened load-bearing wall with pilasters; *2* - log or square-sawn timber traverse; *3* - tie bars in the form of tension bars or snap ties; *4* - reinforcing steel guys; *5* - tension couplings

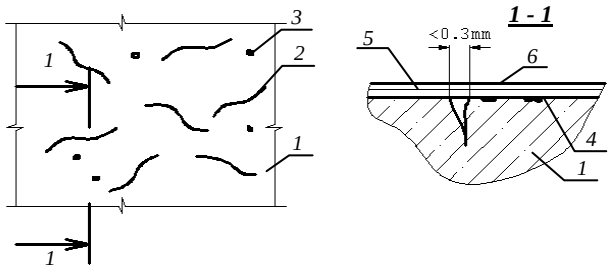
SETTING OF STRUTS



1 - load-bearing wall to be strengthened; *2* - stable building; *3* - log or square-sawn timber posts; *4* - snap ties for attaching posts to walls; *5* - log or square-sawn timber struts; *6* - board bracings

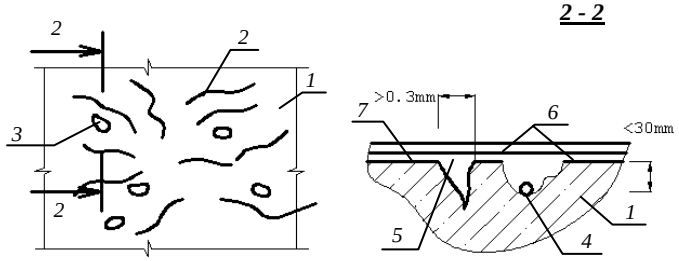
WAYS OF ELIMINATING THE DEFECTS ON LARGE-PANEL EXTERNAL WALL SURFACES

PARTIAL FILLING THE SURFACE WITH PUTTY WITHOUT POINTING UP THE CRACKS



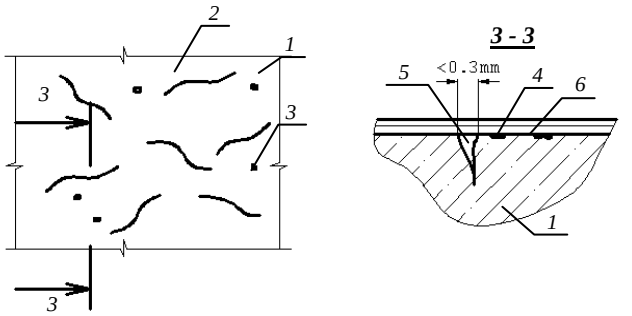
1 - panel to be restored; *2* - cracks about 0.3 mm wide in panel surface with overall crack length less than 10 m/m2; *3* - shallow bugholes not more than one per square meter of panel; *4* - clearing the surface of old coat, cleaning shallow bugholes, air blasting, wetting the putty with solvent; *5* - partial filling the cracks and bugholes on panel surface with mortar and putty; *6* - new coating

POINTING UP AND PATCHING OF CRACKS, BUGHOLES AND SCALINGS WITH PARTIAL FILLING THE SURFACE WITH PUTTY



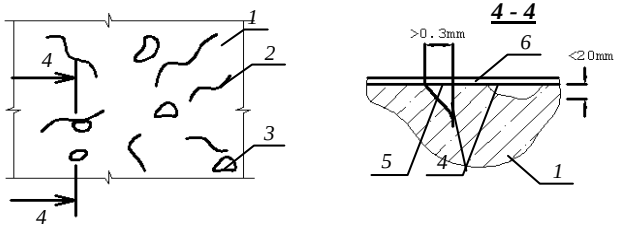
1 - panel to be restored; *2* - cracks over 0.3 nun wide in panel surface layer with overall crack length more than 10 m/m2; *3* - bugholes and scalings about 30 mm deep without reinforcement exposure; *4* – exposed reinforcement; *5* - clearing the surface of old coating, pointing up the cracks, clearing bugholes and scalings, removing rust from expos-ed reinforcement, air blasting, anticorrosion lubrication of reinforce-ment, wetting the putty with solvent (Table 2); *6* - filling the cracks with putty, patching the bugholes and scalings, partial filling the surface with putty or mortar (Table 1); *7* - new coating

OVERALL FILLING THE PANEL SURFACE WITH PUTTY WITHOUT POINTING UP THE CRACKS



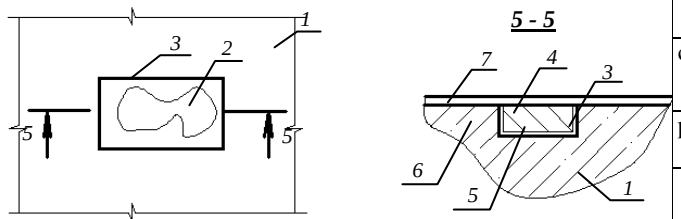
1- panel to be restored; *2* - cracks about 0.3 mm wide in panel surface with overall crack length more than 10 m/m2; *3* - shallow bugholes more than one per square meter of panel; *4* - clearing the surface of old coating air blasting, wetting the putty with solvent; *5* - overall filling the panel surface with solvent or putty (Table 1); *6* - new coating

POINTING UP AND PATCHING OF CRACKS, BUGHOLES AND SCALINGS



1- panel to be restored; *2*- cracks over 0.3 ram wide in panel surface layer with overall crack length less than 10 m/m2; *3*- bugholes and scalings about 15 to 20 mm deep without reinforcement exposure; *4* - clearing the surface of old coating, crack pointing, bugholes and scalings cleaning, air blasting, wetting the putty with solvent; *5* - filling the cracks with putty, patching bugholes and scalings with grout or putty (Table 1); *6* - new coating

PATCHING OF DEEP BUGHOLES WITH ANCHOR BLOCKS



1 - panel to be restored; *2* - deep bughole on panel surface; *3* - bughole changed into hole of simple geometric shape; *4* - anchor block made from the same concrete as panel or cut free old panel; recess surface cleaned, air blasted and wetted; *5* - mortar (Table 1) placed on recess and anchor block surfaces; *6* - new coating

Table 1

Compounds for patching visible cracks and bugholes up to 40 mm deep in panel surface layer

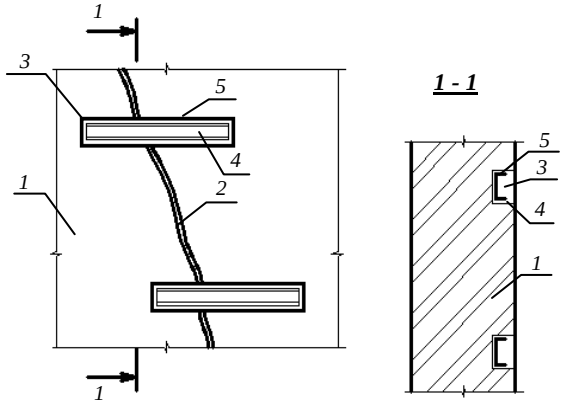
Name	Composition
cement-perchlor vinil putty	1:0.8:0.3 (cement:pain:chalk)
porous cement-lime mortars	from 1:0,2:4 to 1:0.2:6 (cement: lime:sand)

Compounds for patching visible cracks and bugholes up to 40 mm deep in panel surface layer

Type of parget	Composition, mass ratio
Cement-bitumen	Bitumen BH 90310-1; toluene 1.5, cement - 6
Cement-casein	cement -100; casein-5; sodium nitratus-10; water-40
Cement-polystyrene	polystyrene 30; glue-10; cement-14; ground sand-2

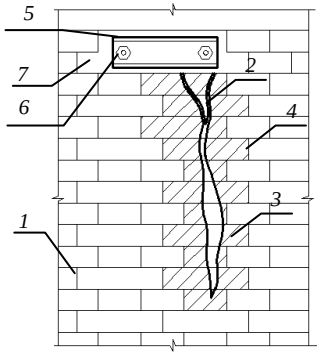
PATCHING OF CRACKS IN BRICK WALLS

FIXING OF ROLLED METAL DOWELS



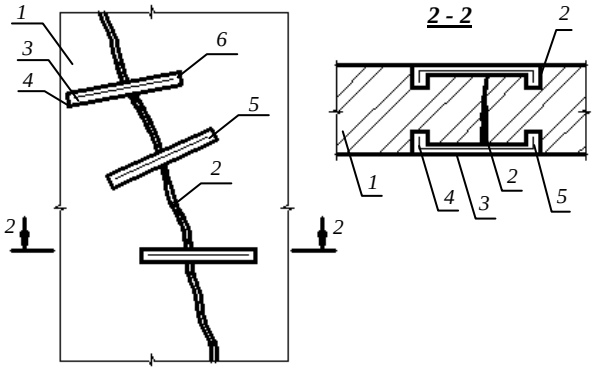
1 - wall under strengthening; *2* - crack in the wall about 10 mm wide injected by cement-sand mortar after fixing the dowels; *3* - toothing in the wall; *4* - rolled metal dowel (channels, angle); *5* - cavities filled with conc)

PATCHING OF WIDE CRACKS BY INSERTING THE BRICK KEYS WITH ANCHOR



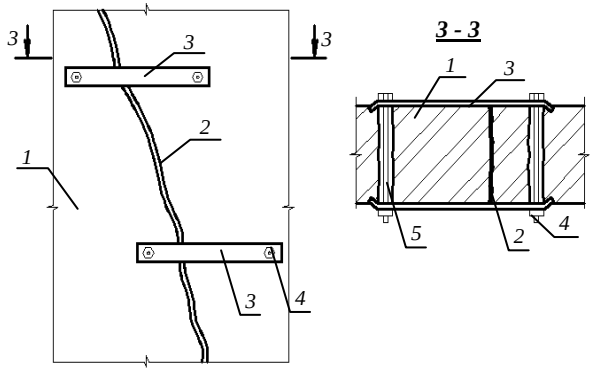
1 - wall under strengthening; *2* - wide crack in the wall (more than 10 mm); *3* - key half a brick thick placed both sides of damaged area; *4* - outline of damaged masonry disassembly; *5* - rolled metal anchor (channel, double-tee) from two sides; *6* - anchor ties (bolts); *7* - cantiliver filled with cement-sand mortar

SETTING OF REINFORCING STEEL BRACE



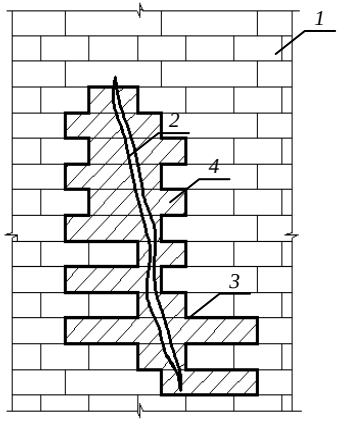
1 - wall under strengthening; *2* - crack in the wall about 10 mm wide injected by cement-sand mortar after fixing the braces); *3* - reinforce-ing steel braces; *4* - milled, groove in masonry; *5* - drilled pockets at the groove ends; *6* - grooves and pockets filled with cement-sand mortar

SETTING OF DOUBLE-SIDED METAL COVER PLATES ON BOLTS



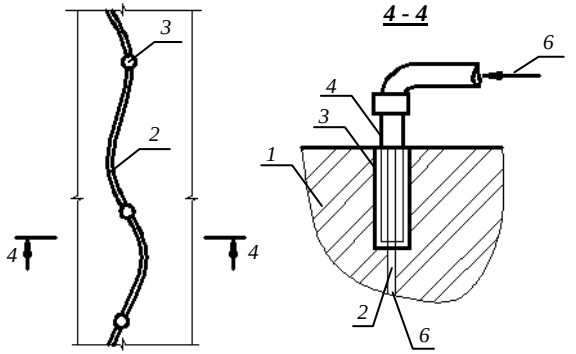
1 - wall under strengthening; *2* - crack in the wall about 10 mm wide injected by cement-sand mortar after setting the cover plates; *3* - strip steel cover plates; *4* - coupling bolts; *5* - holes in the wall for bolts (should be filled with cement-sand mortar after fixing the bolts)

PATCHING OF WIDE CRACKS BY INSERTING THE SIMPLE BRICK KEYS



1 - wall under strengthening ; *2* - wide crack in the wall (more than 10 mm); *3* - key half a brick thick placed both sides of damaged area; *4* - outline of damaged masonry disassembly

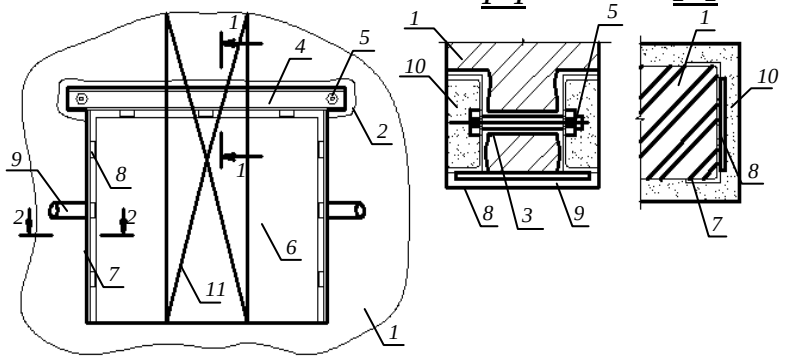
INJECTING OF CRACKS UP TO 10 MM WIDE BY CEMENT-SAND MORTAR



1 - wall under strengthening; *2* - crack in the wall not more than 10 mm wide; *3* - 30 mm disaster holes not less than 100 mm deep for setting the injectors (spaced at 800-1500 mm); *4* - 20- 25 mm diameter injectors (steel pipes) fixed into holes on cement mortar; *5* - outer parts of cracks caulked in with glue; *6* - expending cement-sand mortar (1:3) under pressure up to 0,25MPa

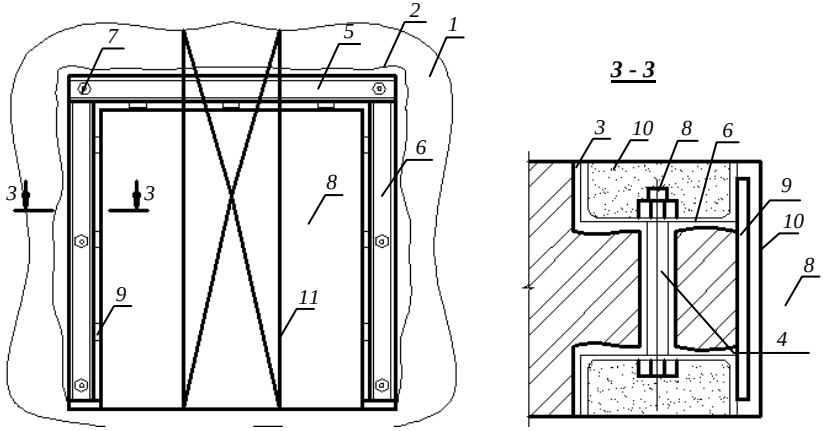
FORMATION OF OPENINGS IN STONE WALLS

FORMATION OF OPENINGS IN NON-BEARING AND BEARING WALLS WITH CHANNEL LINTEL BEAMS POSITIONING AND FRAMING THE OPENINGS WITH ANGLES



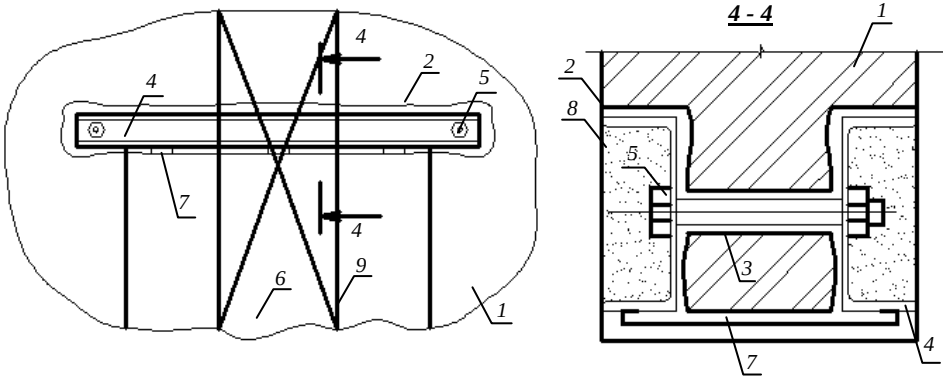
1 - non-bearing or bearing wall; *2* - horizontal joggle in the wall for placing channel lintel beams; *3*- holes in the wall for coupling bolts; *4* - channel lintel beams; *5* - coupling bolts; *6* - opening in the wall made after lintel beams positioning; *7* - framing the opening with metal angles having bearing bases (the upper base is welded to lintel beam); *8* - welded connection planks; *9* - brace made of steel strip and coupling bolt for increasing the stability of angle framing in wall panel; *10* -plastering on mesh;*11*-temporary relieving posts under floor over the opening for bearing walls

FORMATION OF OPENINGS IN BEARING WALLS WITH CHANNEL FRAMES POSITIONING



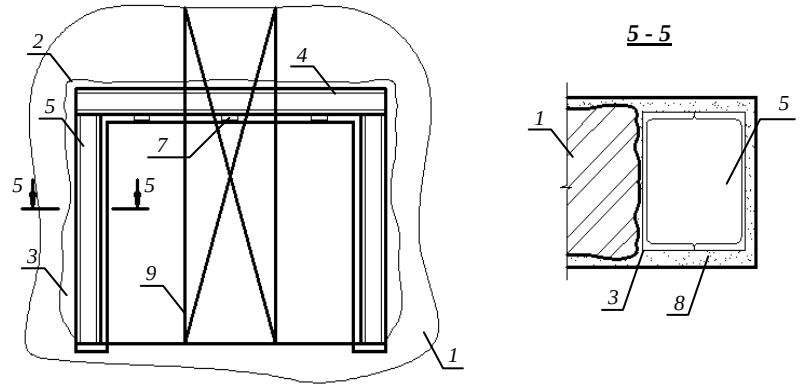
1 - bearing wall; *2* - horizontal joggle in the wall for channel lintel beam; *3* - vertical joggles for setting channel frame posts; *4* - holes in the wall for coupling bolts; *5* - channel lintel beams; *6* - posts of channel frames having bearing bases; *7* - coupling bolts; *8* - opening in the wall made after frames positioning; *9* - welded connection planks; *10* - plastering on mesh; *11* - temporary relieving posts under floor over the opening

FORMATION OF OPENINGS IN NON-BEARING AND BEARING WALLS WITH POSITIONING CHANNEL LINTEL BEAMS



1 - non-bearing or bearing wall; *2* - joggles in wall for positioning channel lintel beams; *3* - holes in the wall for coupling bolts; *4* - channel lintel beams; *5* - coupling bolts; *6* - opening in the wall made after lintel beam positioning; *7* - welded connection planks; *8* - plastering on mesh; *9* - temporary relieving posts under floor over the opening for bearing walls

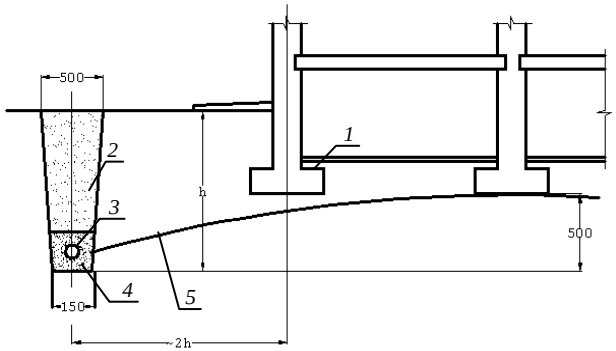
FORMATION OF OPENINGS IN BEARING WALLS WITH CHANNEL FRAMES POSITIONING



1 - bearing wall; *2* - horizontal joggle in the wall for channel lintel beams positioning; *3* - opening in the wall for setting channel posts welded in box (the opening width being 50 mm more than the posts width); *4* - channel lintel beams welded to posts; *5* - channel frame posts (with bearing bases) welded in box; *6* - opening in the wall made after frames positioning; *7* - welded connection planks; *8* - plastering on mesh; *9* - temporary relieving posts under floor over the opening

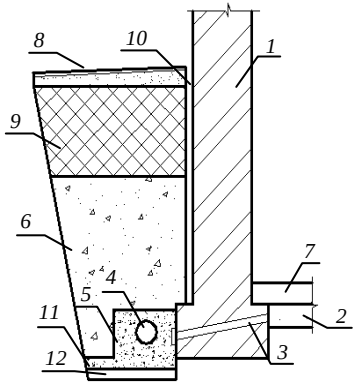
PROTECTION OF FOUNDATION BRICK WALLS AGAINST WETTING

ARRANGEMENT OF RING DRAINAGE AROUND BUILDING



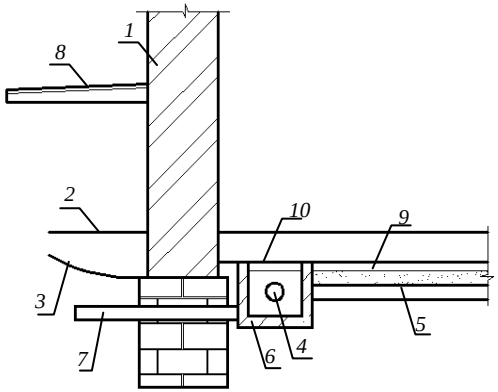
1 - foundation of existing building; *2* - drain; *3* - drainage pipe with 0.002 slope to catch pit; *4* - crushed aggregate bed; *5* - ground water level after drainage arrangement

ARRANGEMENT OF WALL DRAINAGE FROM THE EXTERIOR OF THE BUILDING



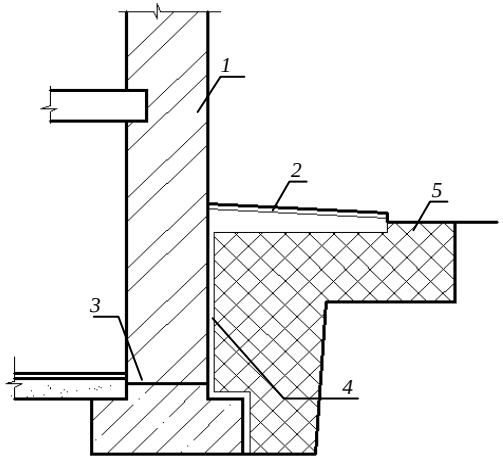
1 - wall to be dried; *2* - flat filter (gravel-sand mix); *3* - outfall sewer; *4* - drain pipe; *5* - stones and 30 to 70mm size pebble; *6* - wall drainage (gravel-sand mix with particle size from 1 to 20mm); *7* - floor of dried storey; *8* - water-tight pitched work; *9* - packed local soil; *10* - membrane aterproofing; *11* - clay concrete; *12* - crushed aggregate rammed into soil

ARRANGEMENT OF SYSTEMATIC DRAINAGE IN EXISTING BUILDING BASEMENT



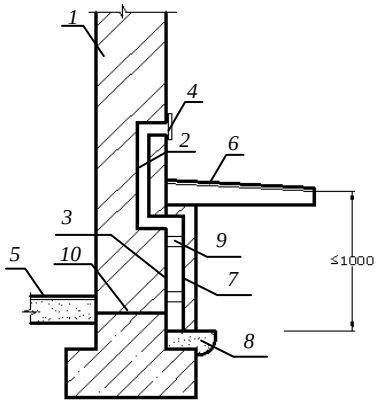
1 - wall to be dried; *2* - initial level of ground water; *3* - lowered level of ground water; *4* - collectors; *5* - drain-desiccators (to be set in collector); *6* - sink; *7* - outfall sewer; *8* - pitched work; *9* - basement floor; *10* - sink lattice

ARRANGEMENT OF CLAY LOCK



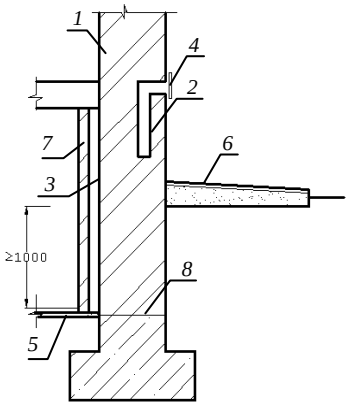
1 - wall to be dried; *2* - watertight pitched work; *3* - existing horizontal hydraulic seal; *4* - applied vertical glued hydraulic seal; *5* - clay look (densely packed clay soil)

ARRANGEMENT OF AIR SLOT FROM THE EXTERIOR OF THE WALL



1 - wall to be dried; *2* - duct cut out in the wall; *3* - air slot; *4* - register; *5* - floor of aerated storey; *6* - pitched work; *7* - air slot wall made of brick 120mm thick; *8* - concrete platform under wall; *9* - struts; *10* - existing hydraulic seal

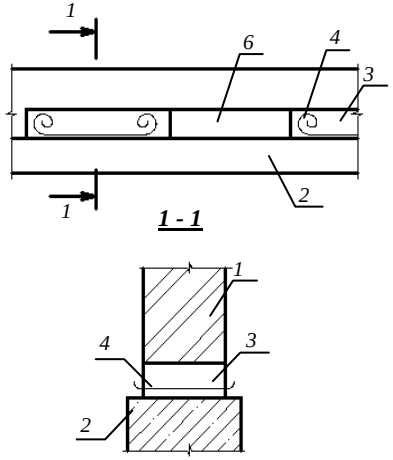
ARRANGEMENT OF AIR SLOT FROM THE INTERIOR OF THE WALL



1 - wall to be dried; *2* - duct cut out in the wall; *3* - air slot; *4* - register; *5* - floor of aerated storey; *6* - pitched work; *7* - air slot wall made of brick 120 mm thick; *8* - existing hydraulic seal

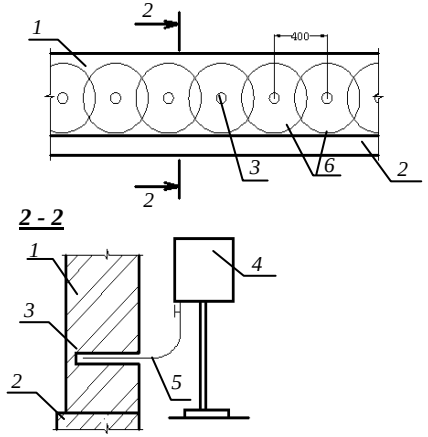
RESTORATION OF BRICK WALLS HORIZONTAL HYDRAULIC SEAL

ADDITIONAL APPLICATION OF HYDRAULIC SEAL ROLL



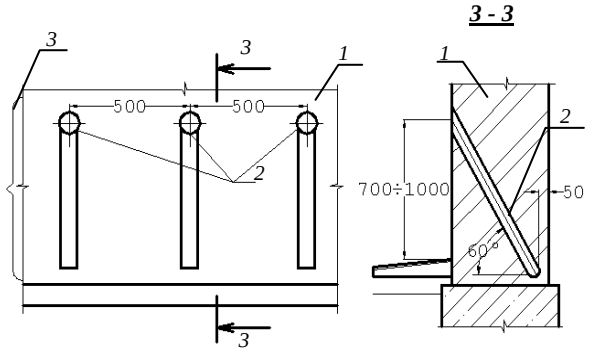
1 - brick wall; *2* - building plinth; *3* - hole cut out in brick masonry (to be packed after hydraulic seal placing); *4* – hydraulic seal roll on cement-sand mortar base course; *5* - hole to be cut out

APPLICATION OF HYDRAULIC SEAL BY INJECTING THE SILICONORGANIC COMPOUNDS



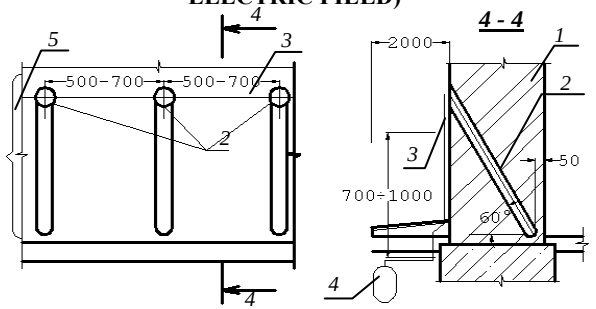
1 - dried brick wall; *2* - building plinth; *3* - intjectors set in holes drilled in the wall; *4* - tank with ГКЖ-10 or ГКЖ-11 siliconoorganic compound solu-tions; *5* - rubber hose distributing pipe line; *6* - boundary of wall solution treatment

APPLICATION OF HYDRAULIC SEAL BY ZEROPOTENTIAL METHOD (DESTRUCTION OF ELECTRIC FIELD)



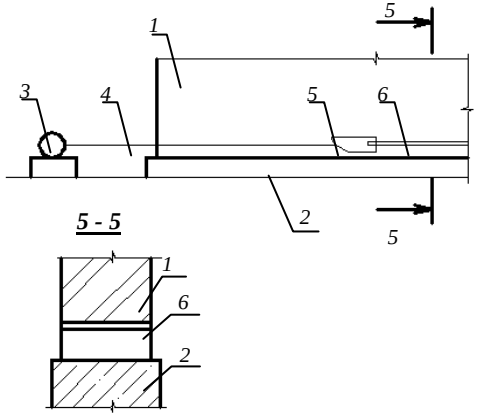
1 - brick wall; *2* - 10 to 20 mm diameter steel rods set in drilled holes to be filled with cement-sand mortar; *3* - zone without electric field (penetration of soil moisture into the wall is excluded)

APPLICATION OF HYDRAULIC SEAL BY PROTECTION METHOD (CREATION OF ARTIFICIAL ELECTRIC FIELD)



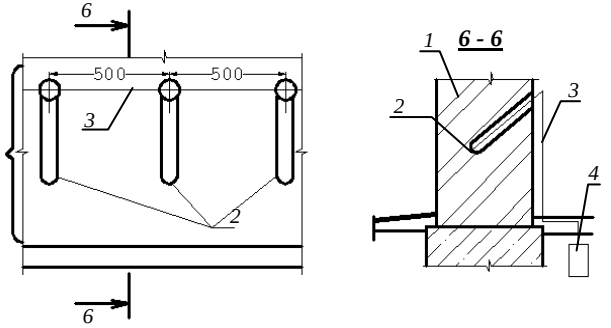
1 - brick wall; *2* - 10 to 20 mm diameter steel rods set in drilled holes to be filled with cement-sand mortar; *3* - steel wire ties; *4* - protector (ПМ-5У spaced at 50m, ПМІОУ spaced at 100m) below the frozen soil depth; *5* - zone of artificial electric field contrary to natural electric field as to direction (penetration of confined water is excluded)

APPLICATION OF HYDRAULIC SEAL BY ELECTROTHERMAL METHOD



1 - brick wall; *2* - building plinth; *3* - pull winch; *4* - cable; *5* - carbocydic rod (380V pressure, 65A current strength); *6* - hydraulic seal layer from melt brick masonry

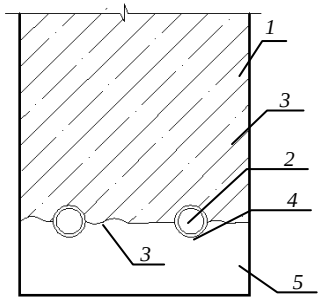
APPLICATION OF HYDRAULIC SEAL BY GALVANOOSMOSE METHOD, SPONTANEOUS INITIATION OF ELECTRIC FIELD



1 - brick wall; *2* - cathodes (copper rods) set in drilled holes to be filled by liquid cements mortar; *3* - connecting wire; *4* - anode (zinc plate) set in soil below freezing zone; *5* - zone of spontaneous initiation of electric field, promoting moisture shift from the wall

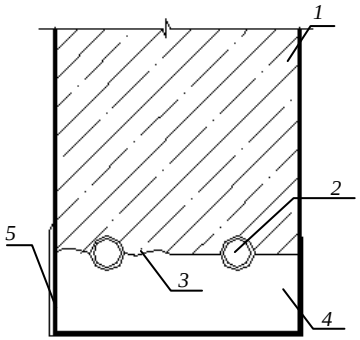
RESTORATION OF CONCRETE PROTECTIVE LAYERS

DENSE CEMENT-SAND MORTAR PLASTERING



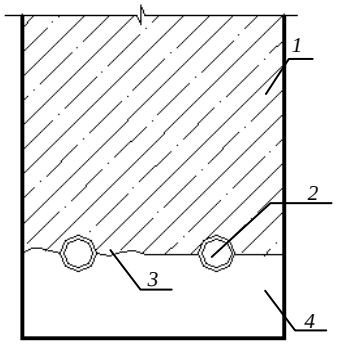
1 - restored structure; *2* - principle reinforcement cleared of corrosion by means of chisel and steel brushes; *3* - structure surface cleared off to concrete with PH over 12 and moistened; *4* - cleared reinforcement coated by casein glue with corrosion retarded (Portland cement - 100, casein glue - 5, nitrate sodium - 10, water - 30-40); *5* - concrete cover restored as a result of plastering by dense cement-sand mortar(1:2.5 to 1:3) concrete cover restored as a result of plastering by dense cement-sand mortar(1:2.5 to 1:3)

DENSE CEMENT-SAND MORTAR PLASTERING WITH VANISH PAINTING FOLLOWING



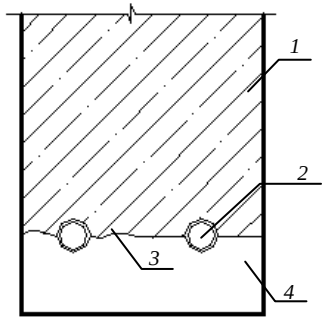
1 - restored structure; *2* - principle reinforcement cleared of corrosion; *3* - structure surface cleared off to concrete with PH over 12, moistened; *4* - concrete cover restored by means of 1:2 cement-sand mortar; *5* - crack-resistant vanish paint

CEMENT CONCRETE PLACING



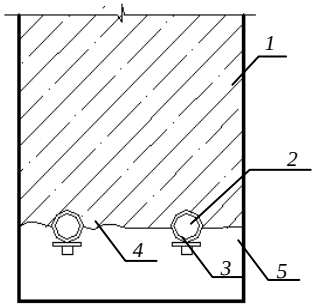
1 - restored structure; *2* - principle reinforcement cleared of corrosion; *3* - structure surface cleared off to concrete with PH over 12 and moistened; *4* - concrete cover restored as a result of guniting by dense cement-sand mortar, the strength of mortar being not less than strength of structure under restoration

POLYMER CONCRETE PLACING



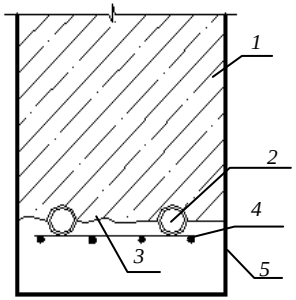
1 - restored structure; *2* - principle reinforcement cleared of corrosion; *3* - structure surface cleared off to concrete with PH over 12, moistened; *4* - restored protective polymer concrete layer (epoxy resin - 100,coal lacquer - 100, liquid thiokol - 20, amine bardener - 10, cement 100÷150)

CEMENT CONCRETE PLACING



1 - restored structure; *2* - principle reinforcement cleared of corrosion; *3* - reinforcing steel cover plates welded to principle reinforcement of corrosion damaged section; *4* - structure surface cleared off to concrete with PH over 12, moistened and covered with 1:2 cement-sand mortar layer; *5* - concrete cover restored as a result of concreting or guniting (in 1.5 hours after placing the mortar)

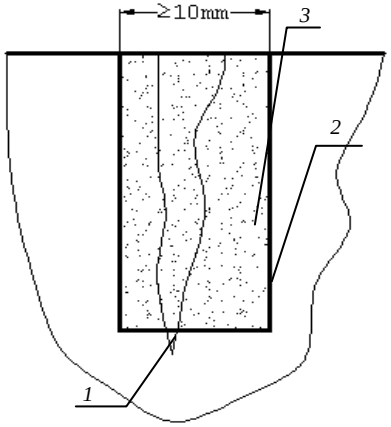
DENSE CEMENT-SAND MORTAR GUNITING



1 - restored structure; *2* - principle reinforcement cleared of corrosion by means of chisel and steel brushes; *3* - structure surface cleared off to concrete with PH over 12 and moistened; *4* - 2 to 3 mm diameter wire reinforcing fabric with 50x50 cell welded to reinforcement; *5* - concrete cover restored as a result of guniting by dense cement-sand mortar (1:1 or 1:1.5) made of Mpa 40 portland cement

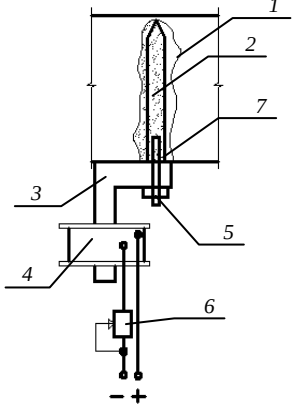
SEALING OF CRACKS IN CONCRETE AND REINFORCED CONCRETE STRUCTURES

PUTTYING OF SHORT SHALLOW CRACKS BY SYNTHETIC MATERIAL



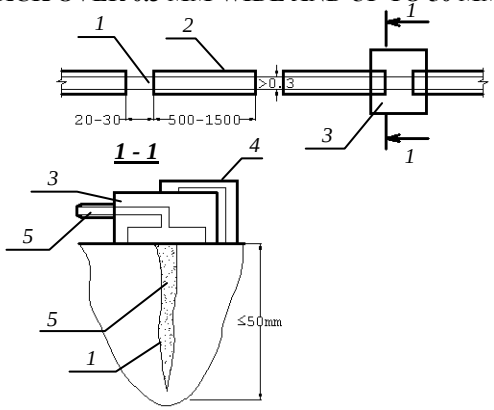
1- crack in structure (short and shallow); *2* - milled groove; *3* – synthetic putty

INJECTION OF TAMPING GROUT WITH MAGNETIC PROPERTIES



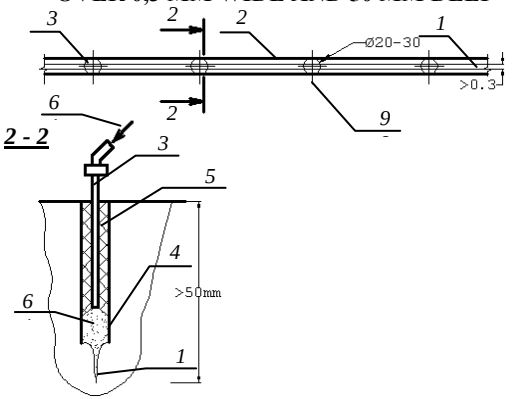
1 - crack in structure; *2* - metal pintle-magnetic pipes with effective spacing along crack length (to be preserved after sealing the cracks); *3* - pole tip; *4* - electromagnet; *5* - bolt for fastening the tip; *6* - rheostat; *7* - magnet based tamping grout drawn into crack under the action of magnetic field and retained in it

INJECTION OF CEMENT-SAND-MORTAR INTO CRACK OVER 0.3 MM WIDE AND UP TO 50 MM DEEP



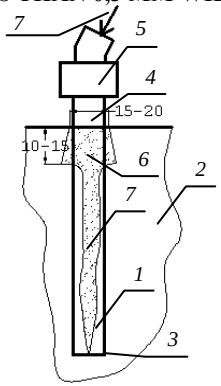
1 - crack in structure (not more than 50 mm deep); *2* - area patched with concrete, glue or strip; *3* - surface type injector (deadended, circulating, vacuum); *4* - fixing of injector (by cramps bolts, etc); *5* - expanding cement mortar with W/C *= 0,6-2 or synthetic resins (to be pumped)

INJECTION OF CEMENT-SAND MORTAR INTO CRACK OVER 0,3 MM WIDE AND 50 MM DEEP



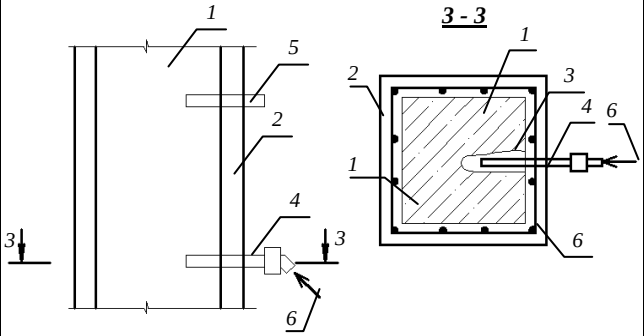
1 - crack in structure (over 50 mm deep); *2* - area patched with concre- te, glues or strip; *3* - pressure injection pipe; *4* - drilled well; *5* - rubber compactor; *6* - expanding cement mortar with W/C = 0,6-2 or synthe-tic resins (to be pumped)

INJECTION OF CEMENT-SAND MORTAR INTO CRACK LESS THAN 0,3 MM WIDE



1 - crack in structure; *2* - slushed grooved crack with inside expanion; *3* - drilled hole for setting and grouting the injection pipe; *4* – injection pipe; *5* - coupling with nut for connecting hose to injection pipe; *6* - 1:1 cement-sand mortar for filling the groove; *7* - expanding cement mortar with W/C = 0.7÷2 for filling the cracks under 490-1960kN/cm2 pressure

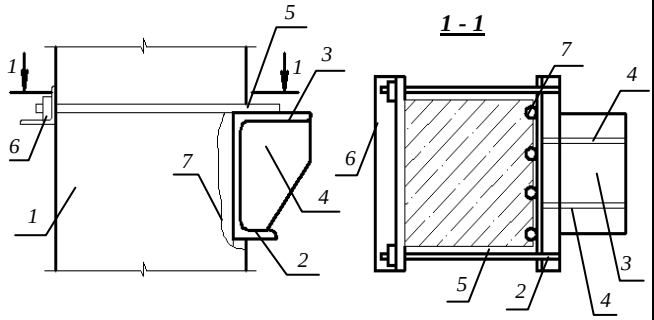
PATCHING OF WIDE CRACKS BY SIMULTANEOUS ARRANGEMENT OF YOKE



1 - structure under trengthening; *2* - reinforced concrete yoke; *3* - wide crack; *4* - injection tube set in crack before yoke arrangement; *5* - control tube set in crack before yoke arrange-ment; *6* - mortar or concrete pumped after yoke concrete gaining strength

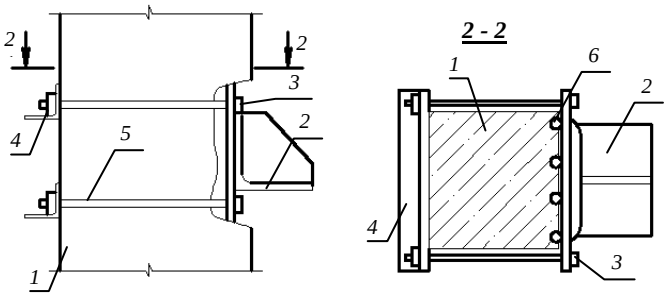
RESTORATION OF CAST-IN ITEMS IN REINFORCED CONCRETE MEMBERS

ARRANGEMENT OF CANTILEVERS AT COLUMNS



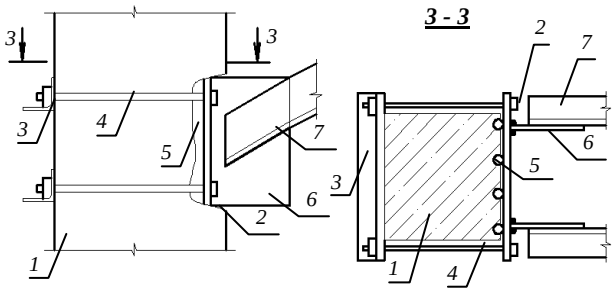
1 - column; *2* - channel; *3* - supporting prop sheet; *4* - stiffening ribs; *5* - coupling bolts; *6* - anchor angle-washer; *7* - exposed reinforce-ment of column (to be caulked with cement-sand mortar after welding the plate)

FASTENING OF PROPS TO COLUMNS FOR SUPPORTING THE WALL PANELS



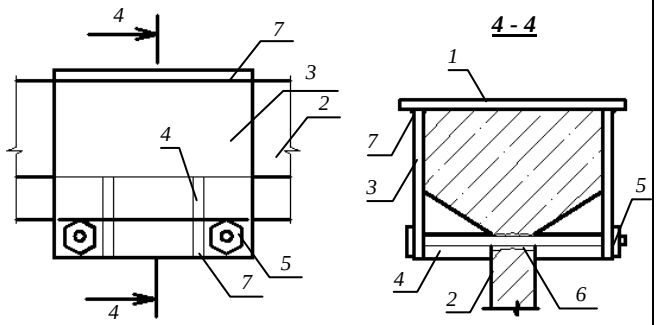
1- column; *2* - angle supporting prop with stiffening rib; *3* - plate with holes for bolts; *4* - anchor angle-washer; *5* - coupling bolts; *6* –expo-sed reinforcement of column (to be caulked with cement-sand mortar after welding the plate)

FASTENING OF TIES TO COLUMN



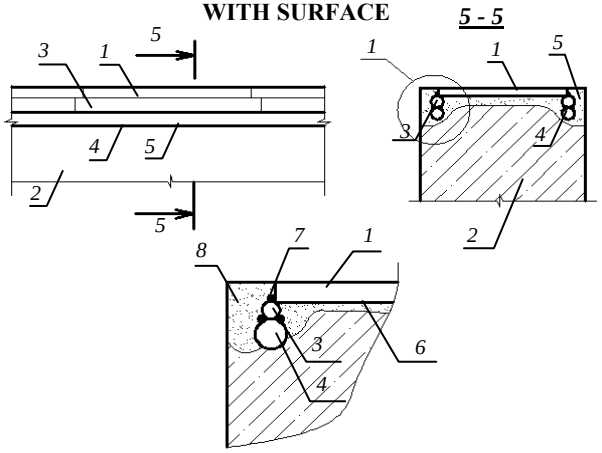
1 - column; *2* - plate with holes for bolts; *3* - anchor angle-washer; *4* - coupling bolts; *5* - exposed reinforcement of columns (to be caulked with cement-sand mortar after plate welding); *6* - tie gusset; *7* - tie angles

PLACING OF MISSED STIRRUP-TYPE CAST-IN ITEM IN BEAM



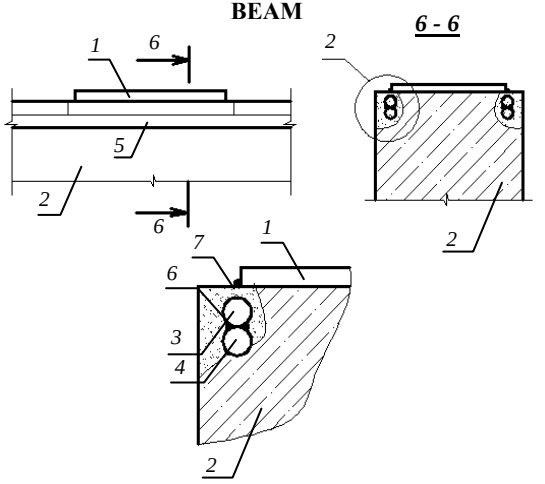
1 - cast-in item to be placed; *2* - beam; *3* - sheet jig of stirrup; *4* - stif-fening ribs; *5* - coupling bolts; *6* - holes for bolts(should be filled with cement-sand mortar after fastening the bolts); *7* - welding

PLACING OF MISSED CAST-IN ITEM IN BEAM FLUSH WITH SURFACE



1 - cast-in item; *2* - beam; *3* - round reinforcement short rod-pad (diameter is determined according to the position); *4* - beam reinforcement; *5* - cut out protective concrete layer; *6* - lateral groove in beams for placing the item; *7* - welding; *8* - cement-sand mortar

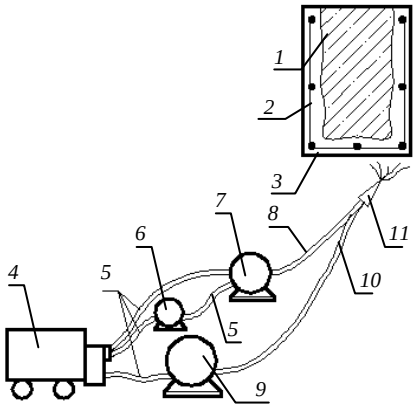
PLACING OF MISSED CAST-IN ITEM ABOVE THE BEAM



1 - cast-in item; *2* - beam; *3* - round reinforcement short rod-pad; *4* - beam reinforcement; *5* - cut out protective concrete layer of beam; *6* - welding; *7* - cement- sand mortar

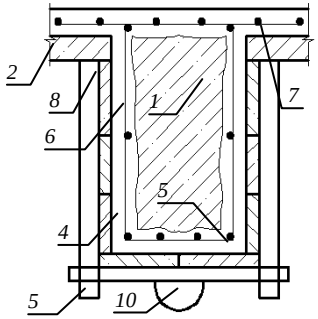
CONCRETING OF YOKES, JACKETS AND SPLICES IN STRENGTHENING THE REINFORCED CONCRETE STRUCTURES

CONCRETING OF YOKES, JACKETS AND SPLICES OF SLABS, BEAMS AND COLUMNS BY GUNITING



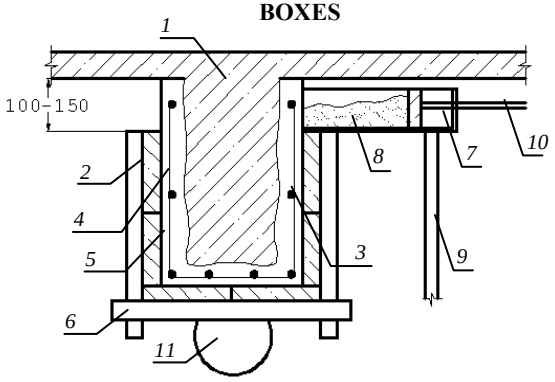
1 - reinforced concrete structure under strengthening; *2* - reinforcement of strengthening; *3* - gunite of yoke, jacket or splice; *4* - compressor; *5* - air hoses; *6* - air cleaner; *7* - cement gun; *8* - material hone; *9* - water tank; *10* - water hose; *11*- nozzle

CONCRETING OF BEAM YOKES AND JACKETS THROUGH SLAB HOLES



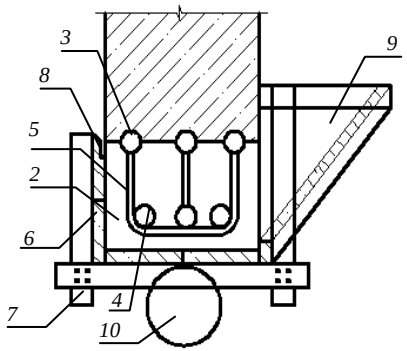
1 - beam under strengthening; *2* - slab; *3* - holes cut out in slab for placing stirrups and concrete (the width of the hole is equal to yoke thickness, length being 100 mm, the spacing between the holes being 300 mm); *4* - strengthening of beam by yoke (jacket); *5* - longitudinal reinforcement of yoke (jacket); *6* - yoke (jacket) stirrups; *7* - yoke mesh; *8* - formwork box; *9* - stiffening ribs of formwork box;
10 - suspended vibrator

CONCRETING OF BEAM JACKETS BY MEANS OF BOXES



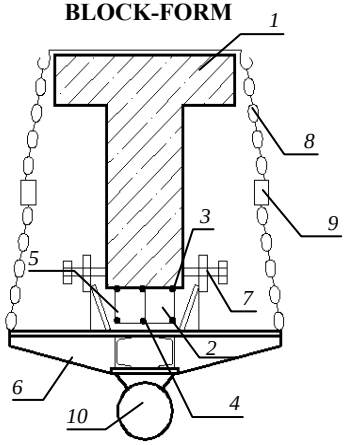
1 - beam under strengthening; *2* - strengthening of beam by jacket; *3* - longitudinal reinforcement of jacket; *4* - jacket stirrups; *5* - form-work box; *6* - stiffening ribs of formwork box; *7* - three-sided movable box for concreting (is taken off for filling with concrete mix); *8* - concrete mix; *9* - support under box; *10* - box concrete pusher; *11* - suspended vibrator

CONCRETING OF BEAM SPLICE FROM THE BOTTOM BY MEANS OF SIDE HOPPERS



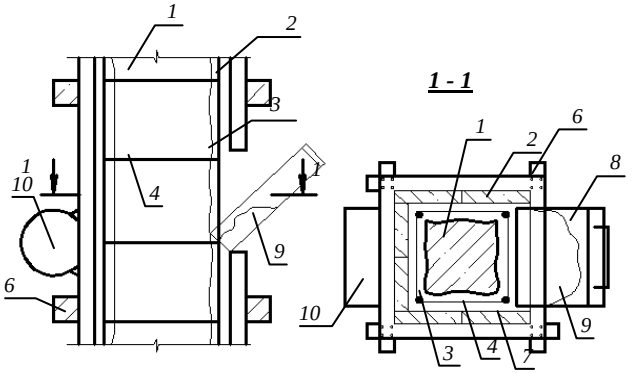
1 - beam under strengthening; *2* - strengthening of beam by splicing; *3* - exposed principle reinforcement of beam under strengthening; *4* - longitudinal reinforcement of strengthening;
5 - stirrups of strengthening; *6* - formwork box; *7*- stiffening ribs of formwork box; *8* - clearance for air deflation and control of splice filling with concrete; *9* - loading side hopper for placing concrete (200 mm wide, spaced at 1-1,5 m)

CONCRETING OF BEAM SPLICES IN INSEPARABLE BLOCK-FORM



1 - beam under strengthening; *2* - strengthening of beam by splicing; *3* - exposed principle reinforcement of beam; *4* - longitudinal reinforce-ment of strengthening; *5* - stirrups of strengthening; *6* - block-form; *7* - spacers; *8* - suspenders (chains); *9* - turnbuckles; *10* - suspended vibrator

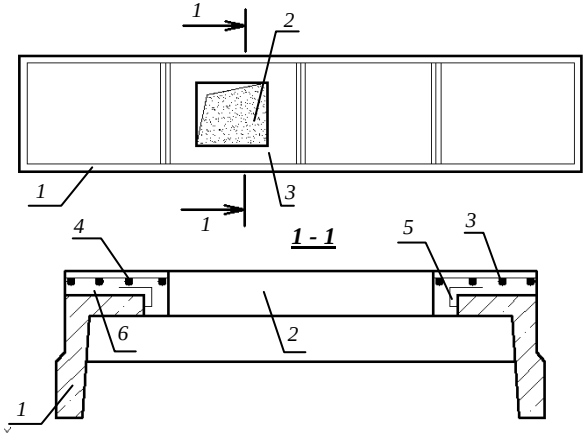
CONCRETING OF COLUMN YOKES BY MEANS OF BOXES



1 - column under strengthening; *2* - strengthening of column by yoke; *3* - longitudinal reinforcement of yoke; *4* - yoke stirrups; *5* - formwork box; *6* - stiffening ribs of formwork box; *7* - loading inlets from each side of formwork box; *8* - three-sided movable box for concreting; *9* - concrete mix;
10 - suspended vibrator

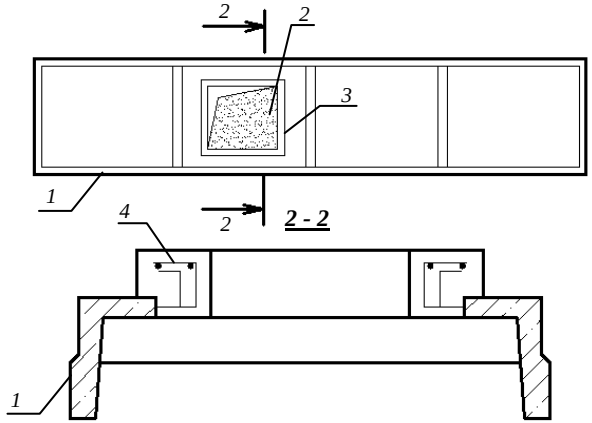
FORMATION OF OPENINGS IN REINFORCED CONCRETE SLABS

SPLICING OF SLAB AROUND THE OPENING



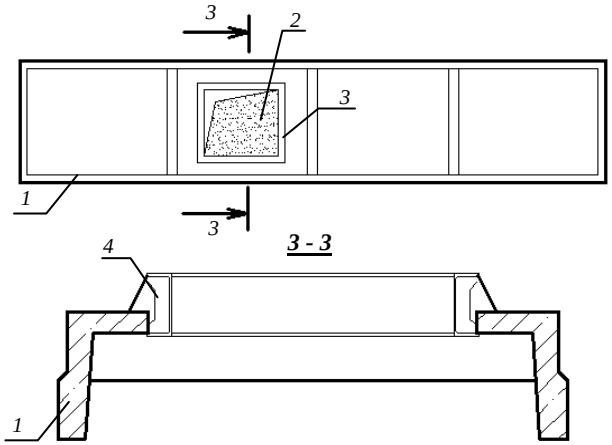
1 - ribbed floor slab; *2* - opening in slab flange; *3* - reinforced concrete splice in the area of opening; *4* - additional reinforcing fabric; *5* - slab reinforcing fabric bent to splice area; *6* - slab surface prepared for placing splice concrete

REINFORCED CONCRETE FRAMING OF THE OPENING



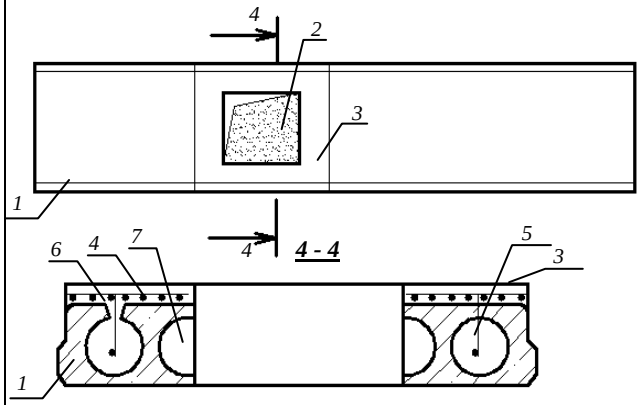
1 - ribbed floor slab; *2* - opening in slab flange; *3* - reinforced concrete framing of opening; *4* - reinforcing of framing; *5* - slab reinforcing fabric extended to framing concrete area

ROLLED METAL FRAMING OF THE OPENING



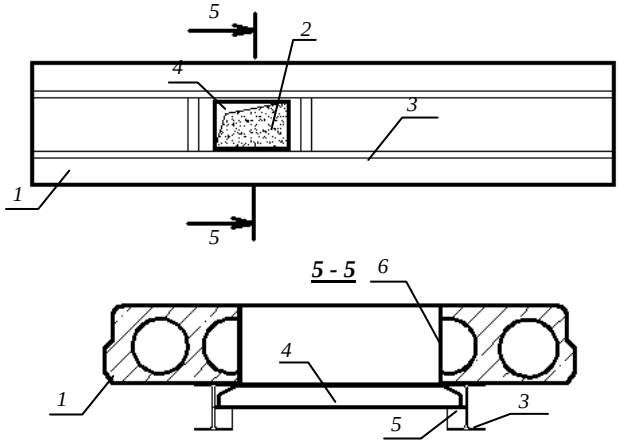
1 - ribbed floor slab; *2* - opening in slab flange; *3* - channel framing of opening; *4* - slab flange reinforcement; *5* - concrete

SPLICING OF SLAB WITH SIMULTANEOUS STRENGTHENING OF TENSILE ZONE



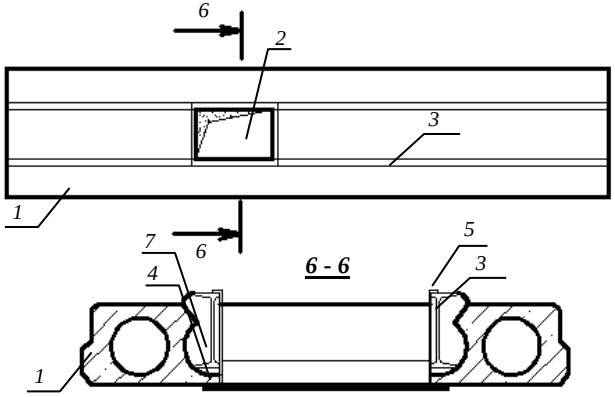
1 - core floor slab; *2* - opening in slab; *3* - reinforced concrete splice in the area of opening; *4* - additional reinforcing fabric; *5* - reinforcement cage set in cavity through the duct in flange; *6* - slab surface prepared for concrete splicing; *7* - cavity concreting

PLACING OF RELIEVING METAL BEAMS



1 - core floor slab; *2* - opening in slab; *3* - metal relieving beams resting on load-bearing structures (cross bars, walls); *4* - angle frame along the perimeter of opening; *5* - metal strip suspenders; *6* - sheet metal framing of opening

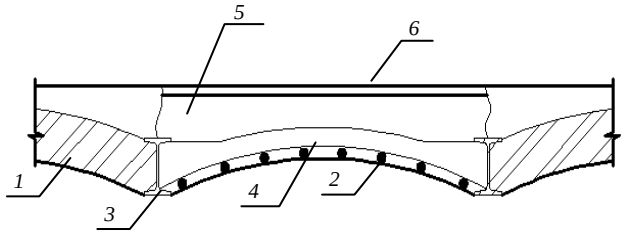
POSITIONING OF METAL BEAMS IN THE AREA OF OPENING



1 - core floor slab; *2* - opening in slab; *3* - metal longitudinal beams resting on load-bearing structures (cross-bars, walls); *4* - channel lateral metal beams; *5* - stiffening ribs; *6* - sheet metal framing of opening; *7* - cavity concreting

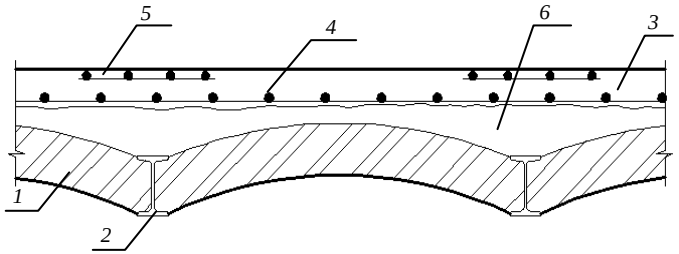
STRENGTHENING OF BRICK FLOORS

ARRANGEMENT OF REINFORCED CONCRETE ARCHED FLOOR INSTEAD OF BRICK FLOOR



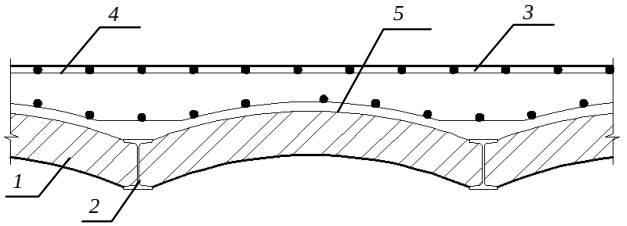
1 - arched brick floor; *2* - reinforced concrete arched floor instead of brick floor; *3* - bearing metal floor beams; *4* - reinforcing fabrics; *5* - expanded clay gravel filling; *6* - restored floor

REINFORCED CONCRETE SLAB-TYPE SPLICING ABOVE THE FLOOR



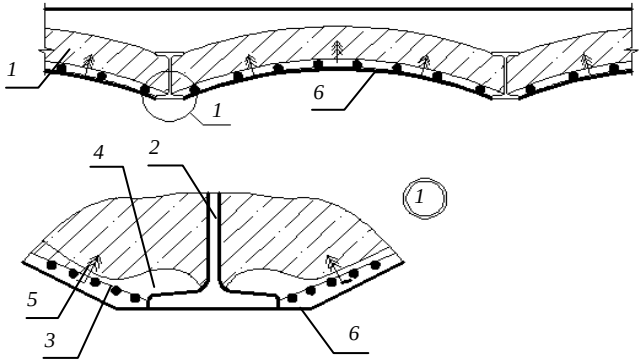
1 - arched brick floor; *2* - bearing metal beasts; *3* - reinforced concrete slabtype splice; *4* - low span strengthening meshes; *5* - upper strengthening meshes above support; *6* - backfill of broken brick and mortar; *7* - floor surface prepared for concreting

REINFORCED CONCRETS ARCH-TYPE SPLICING ABOVE THE FLOOR



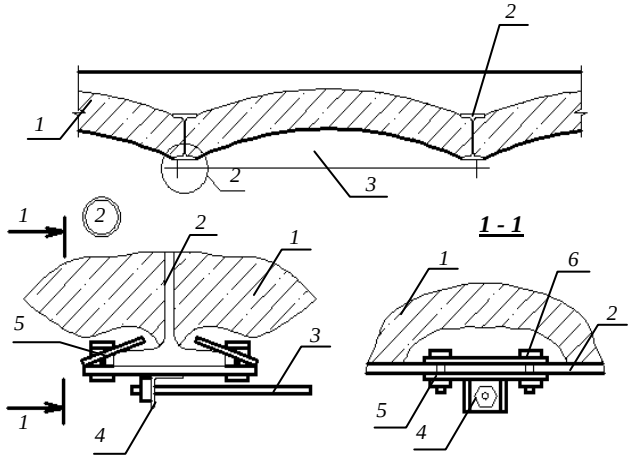
1 - arched brink floor; *2* - bearing metal beams; *3* - reinforced concrete arch-type splice; *4* - reinforcing fabrics; *5* - floor surface prepared for concreting

REINFORCED CONCRETE ARCH-TYPE SPLICIHG BELOW THE FLOOR



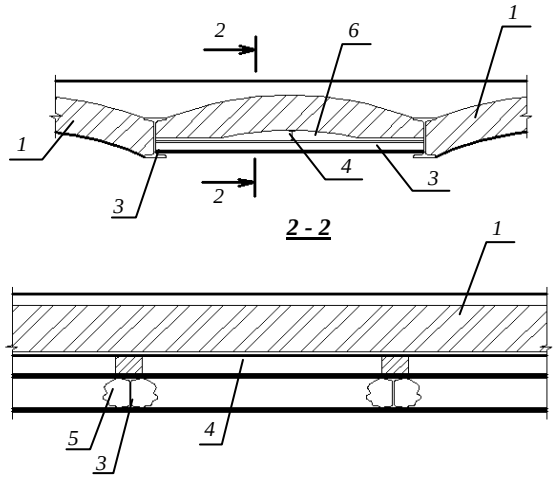
1 - arched brick floor; *2* - bearing metal beams; *3* - reinforcing fabric; *4* - grooves in the floor for supporting reinforced concrete splice; *5* - anchors (rag bolts) driven in masonry joints for fastening

SETTING OF TIES FOR SUSTAINING THE THRUST



1 - arched brick floor; *2* - bearing metal beams (double-tee, rail); *3* - reinforcing steel tie with nuts at the ends; *4* - tie stop in the form of angle with stiffening ribs; *5* - fastener to beam flange fixed by means of plates and bolts; *6* - recesses in floor (should be filled with mortar after fixing the fastener)

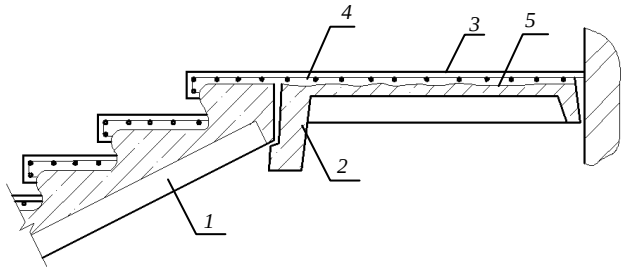
POSITIONING OF RELIEVING METAL BEAMS



1 - arched brick floor; *2* - bearing-metal floor beams; *3* - relieving lateral beams resting on floor beams; *4* - relieving longitudinal beams; *5* - recesses in the floor

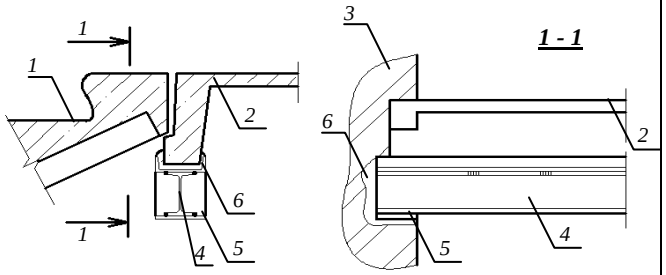
STRENGTHENING OF REINFORCED CONCRETE STAIR FLIGHTS AND STAIR LANDINGS

ARRANGEMENT OF REINFORCED CONCRETE SPLICE IN COMPRESSED ZONE



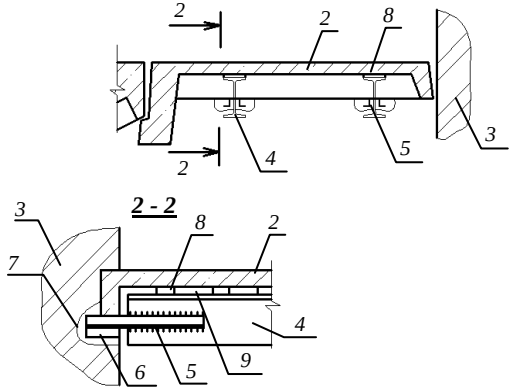
1 - flight of stairs; *2* - stair landing; *3* - reinforced concrete splice of stair landing and steps of flight; *4* - reinforcing fabric; *5* - flight of stairs and stair landing surfaces prepared for concreting (hacked and cleandowned)

POSITIONING OF RELIEVING BEAMS UNDER FRONTAL RIB OF STAIR LANDING



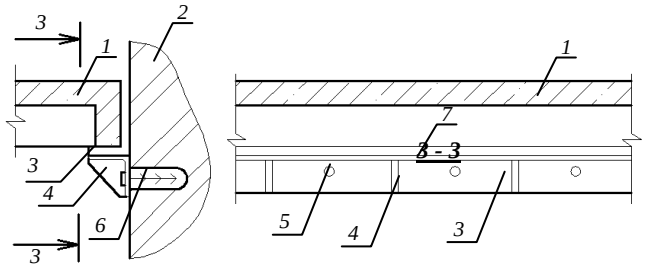
1 - flight of stairs; *2* - stair landing; *3* - wall; *4* - relieving composite beam; *5* - supporting plate; *6* - recess in wall filled with concrete after positioning of beams (structures should be temporarily unloaded during recess arranging and beam positioning)

POSITIONING OF METAL RELIEVING BEAMS UNDER STAIR LANDING



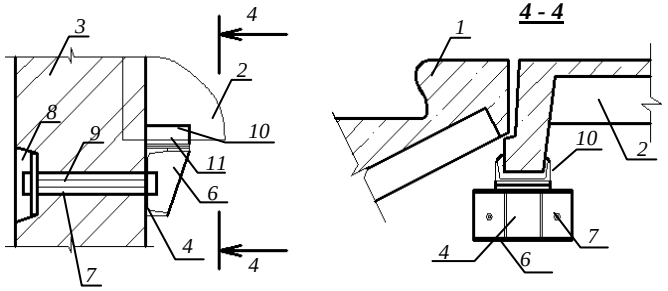
1 - flight of stairs; *2* - stair landing; *3* - wall; *4* - relieving beams (double tee, channel); *5* - supporting angles welded to relieving beams; *6* - supporting plates; *7* - recesses in walls (to be filled with concrete or mortar after placing the relieving beams); *8* - metal plate-wedges for engaging beams into the joint work; *9* - joints filled with mortar

SETTING OF SUPPORTING PROP UNDER WALL RIB OF STAIR LANDING



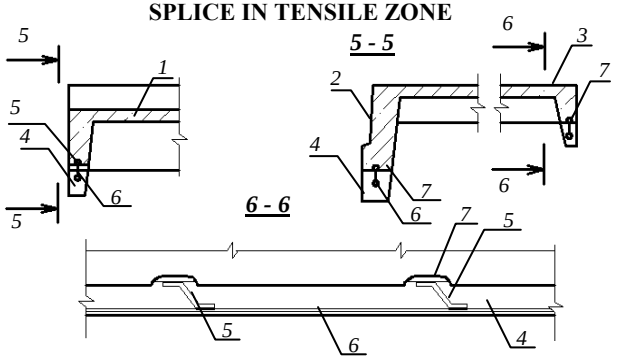
1 - wall rib of stair landing; *2* - wall; *3* - angle supporting prop with holes; *4* - stiffening ribs; *5* – anchor-rag bolt hammered up into treenails; *6* - holes drilled in wall at 15°; *7* - wedging and filling the joint with mortar

SETTING OF SUPPORTING PROPS UNDER FRONTAL RIB OF STAIR LANDING



1 - flight of stairs; *2* - stair landing; *3* - wall; *4* - channel supporting prop; *5* - supporting prop plate; *6* - stiffening ribs; *7* - anchor bolt; *8* - plate-washer; *9* - opening in the wall; *10* - channel supporting pad (to be placed on mortar); *11* - metal plate-wedges for engaging the prop into work

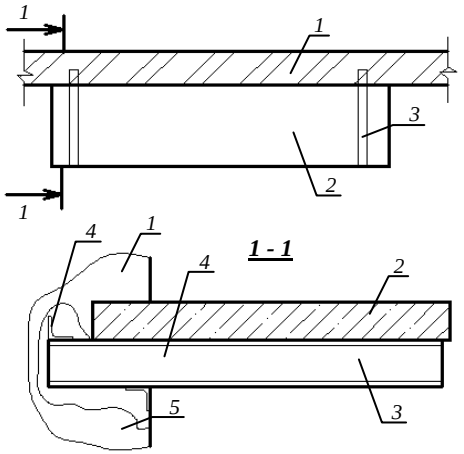
ARRANGEMENT OF REINFORCED CONCRETE SPLICE IN TENSILE ZONE



1- longitudinal ribs of flight of stairs; *2* - frontal rib of stair landing; *3* - wall rib of stair landing; *4* - reinforced concrete splice; *5* - bent reinforcement bars welded to exposed reinforcement and reinforcement of splice; *6* - strengthening reinforcement; *7* - exposed reinforcement of structures under strengthening

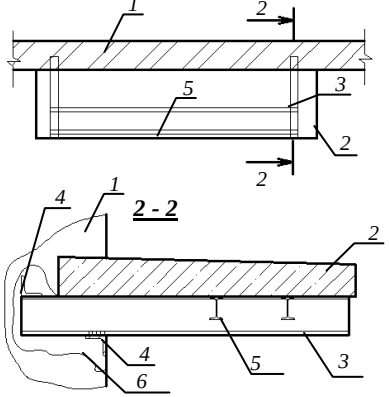
STRENGTHENING OF BALCONY SLABS AND VISORS

POSITIONING OF ROLLED METAL CANTILEVERS



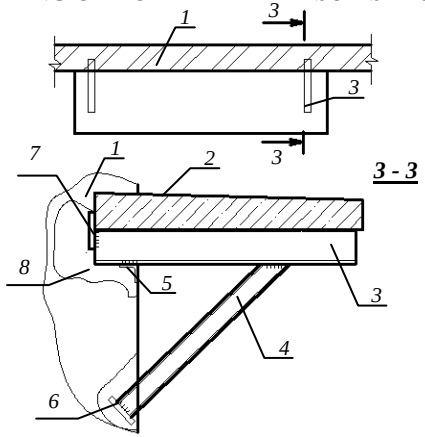
1 - wall; *2* - balcony slab (visor); *3* - rolled metal cantilever (double tee, channel); *4* - supporting angle-pad; *5* - recess in the wall (to be filled with concrete after placing the beams)

POSITIONING OF ROLLED METAL CANTILEVERS AND RELIEVING BEAMS



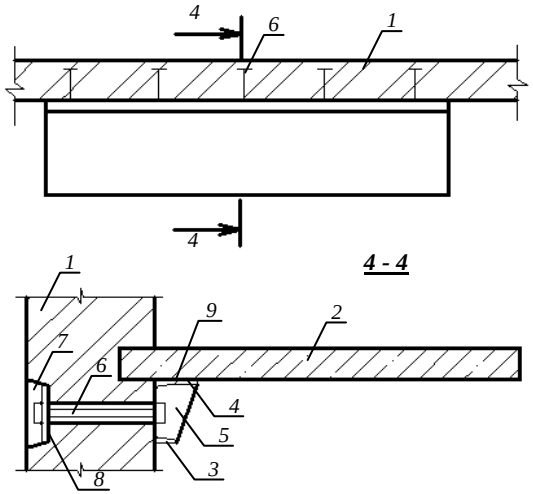
1-wall; *2*-balcony slab (visor); *3*-channel supporting prop; *4* - supporting prop plate; *5* - stiffening rib; *6* - anchor bolts; *7* - plate-washer; *8* - hole in the wall (to be filled with mortar after fastening the bolts);*9*- metal plate-wedges for engaging props into joint work

SETTING OF ROLLED METAL SUB-STRUTS



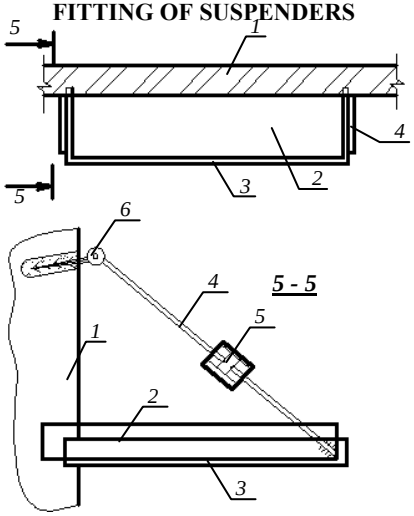
1 - wall; *2*-balcony slab(visor); *3*-rolled metal cantilever (double tee, channel); *4* - rolled metal cantilever sub-struts (double tee, channel); *5* - supporting angle; *6* - supporting plate; *7* - anchor plate; *8* - recess in the wall (to be filled with concrete after placing the substruts)

POSITIONING OF METAL SUPPORTING PROPS



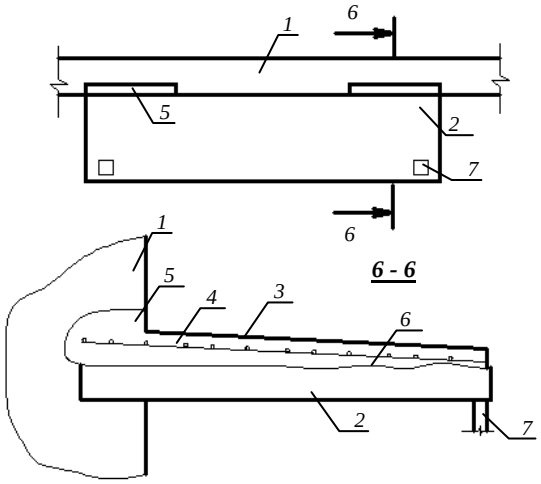
1 - wall; *2* - balcony slab (visor); *3*-channel supporting prop; *4*-sup-porting prop plate; *5* - stiffening rib; *6* - anchor bolts;*7* - plate-washer; *8* - hole in the wall (to be filled with mortar after fastening the bolts); *9*- metal plate-wedges for engaging props into joint work

FITTING OF SUSPENDERS



1-wall; *2* - balcony slab (visor); *3* - angle framing embeded in the wall; *4* - reinforcing steel suspender welded to angle framing and connected to anchor; *5* - turnbuckle; *6* - anchor with ring at the end placed on mortar in the hole drilled in masonry

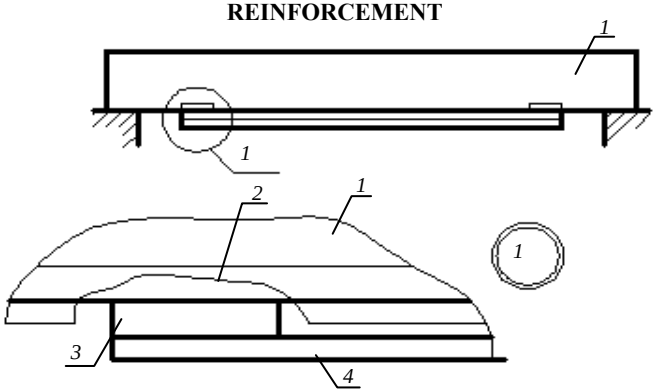
PLACING OF REINFORCED LAYER OF CONCRETE



1-wall; *2*-balcony slab (visor); *3*- reinforced concrete layer; *4* - reinforcing fabric; *5*- recess in the wall sections without openings (to be filled with concrete); *6*-slab surface prepared for con-creting; *7*-temporary struts for the period of concrete strengthening and hardening

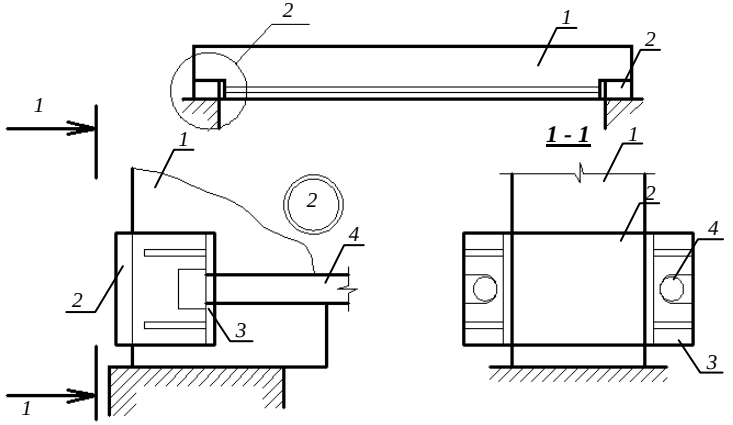
WAYS OF INDUCING PRESTRESSING IN TIES IN STRENGTHENING THE REINFORCED CONCRETE MEMBERS

ELECTROTHERMAL METHOD: WELDING OF HEATED TIE TO EXPOSED REINFORCEMENT



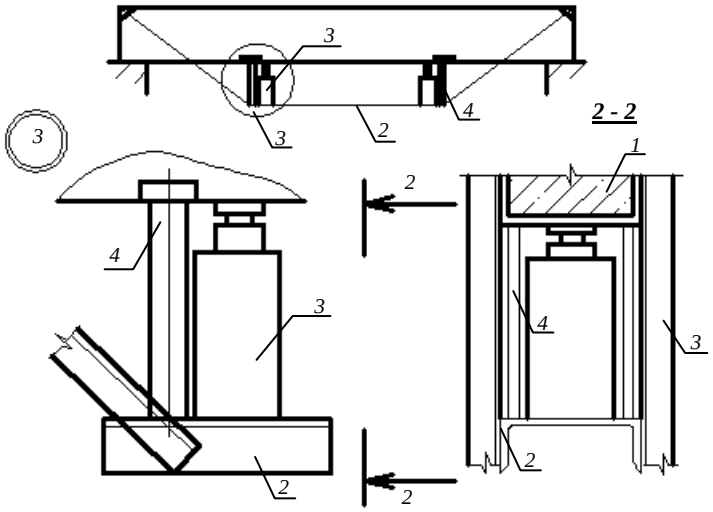
1 - member to be strengthened; *2* - exposed reinforcement (class A-I, class A-II or class A-III); *3* -reinforcing short rods welded to exposed reinforcement; *4* - strengthening reinforcing steel tie (class A-III) heated to 350- 400°C and welded to reinforcing short rods

ELECTROTHERMAL METHOD: SETTING OF HEATED TIE ON STOPS



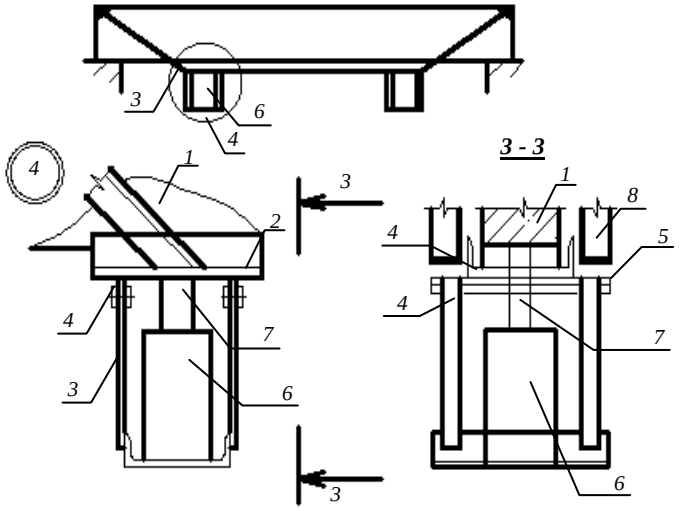
1 - member to be strengthened; *2* - anchor device set on mortar; *3* - stops welded to anchor device; *4* - tie with anchor device placed in heated to 350-400°C state on stops

MECHANICAL METHOD: SETTING OF HYDRAULIC JACKETS BETWEEN THE MEMBER AND THE TIE



1 - member to be strengthened; *2* - strutted tie (horizontal channel section, sloping angle sections); *3* - hydraulic jack; *4* - channel strut (to be set after tensioning the tie)

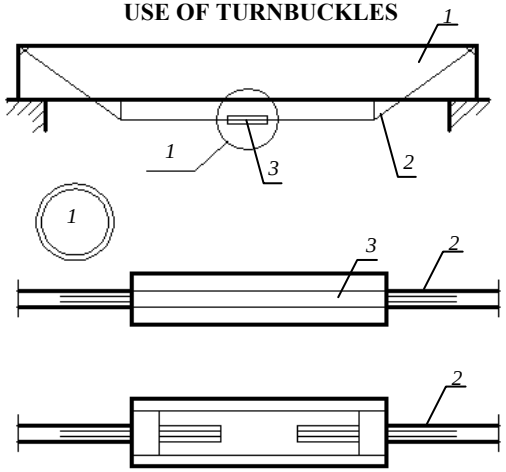
MECHANICAL METHOD: SETTING OF HYDRAULIC JACKETS UNDER THE TIE



1 - member to be strengthened; *2* - strutted tie; *3* - suspended member for fixing the hydraulic jack; *4* - fastening bolts; *5* - support channel (welded to tie) for fixing suspended member; *6* - hydraulic jack; *7* - hydraulic jack piston rod (hole for piston rod is made in channel tie); *8* - sheet pads-stops

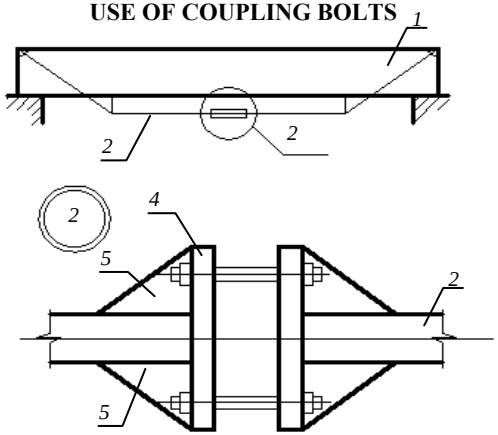
WAYS OF INDUCING PRESTRESSING IN TIES IN STRENGTHENING THE REINFORCED CONCRETE MEMBERS (MECHANICAL METHOD)

USE OF TURNBUCKLES



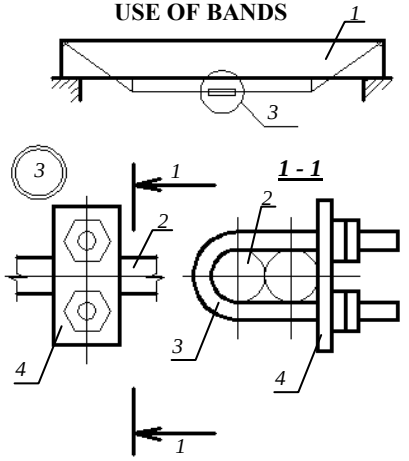
1 - member to be strengthened; *2* - strengthening tie; *3* - turnbuckle

USE OF COUPLING BOLTS



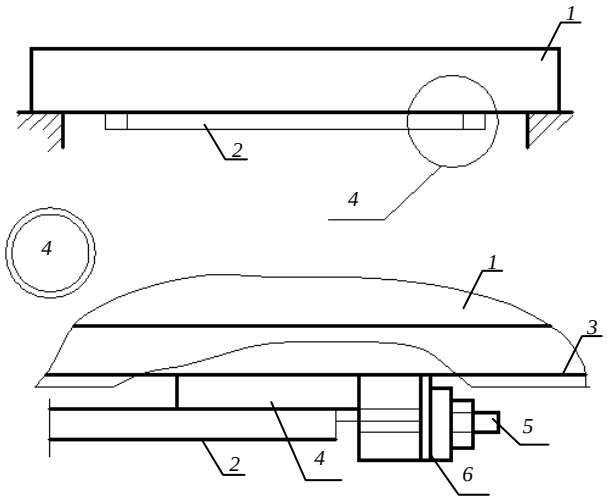
1 - member to be strengthened; *2* - strengthening tie; *3* - coupling bolts; *4* - plates (with holes for bolts) welded to tie elements; *5* - junction plates

USE OF BANDS



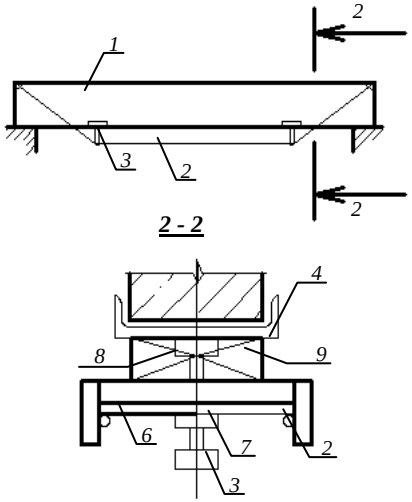
1 - member to be strengthened; *2* - strengthening tie; *3* - band; *4* - band plank

USE OF NUTS



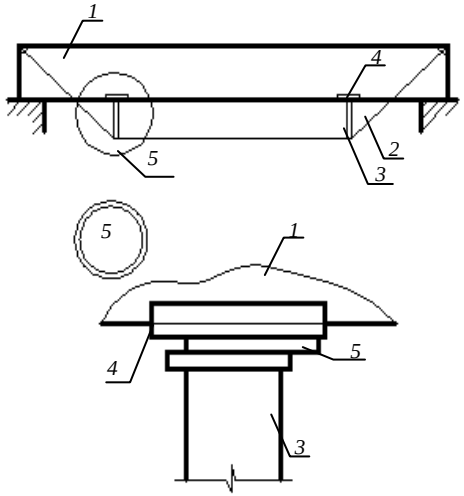
1- member to be trengthened; *2* - strengthening tie; *3* - exposed reinforcement of member to be strengthened; *4* - reinforcing short rod; *5* - bolt with nut welded to tie; *6* - stop (to be taken away after tensioning and welding the tie)

USE OF DRAW BOLTS



1 - member to be strengthened; *2* - strengthening tie; *3* - draw bolt; *4* - support channel; *5* - support sheet; *6* - round pad welded to support sheet; *7* - nut welded into support sheet; *8* - pad with ballon pocket; *9* - set of steel pads (to be placed after tensioning the tie)

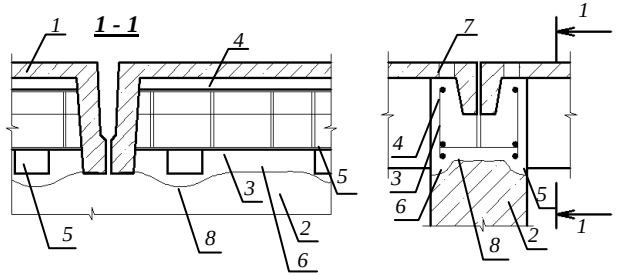
SETTING OF PLATES-WEDGES



1 - member to be trengthened; *2* - strengthening tie; *3* - post; *4* - support channel; *5* - metal plates-wedges (should be welded to each other and to strengthening members)

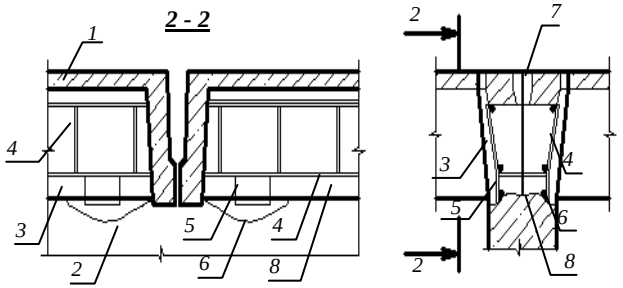
ENGAGEMENT OF STRENGTHENED STRUCTURES INTO JOINT WORK

ARRANGEMENT OF REINFORCED CONCRETE KEYS FOR ENGAGING FLOOR SLABS AND ROOF STRUCTURES INTO JOINT WORK



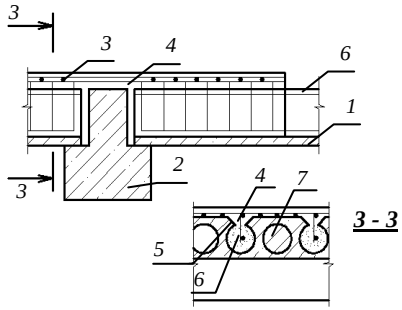
1 - covering slabs; *2* - roof structure (truss beam); *3* - reinforced concrete key; *4* - additional frame; *5* - plates; *6* - exposed reinforcement of roof structure; *7* - holes in slab flanges for concreting; *8* - roof structure surface prepared for concreting

ARRANGEMENT OF REINFORCED CONCRETE KEYS FOR ENGAGING FLOOR SLABS AND CROSS BARS INTO JOINT WORK



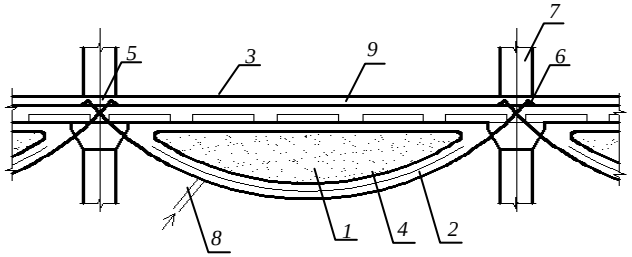
1 - floor slabs; *2* - cross-bar; *3* - reinforced concrete key; *4* - additional frame; *5* - plates; *6* - exposed reinforcement of cross-bar for welding the plates; *7* - holes in slab flanges for concreting; *8* - crossbar surface prepared for concreting

FORMATION OP FLOOR SUB WORK CONTINUOUS SCHEME



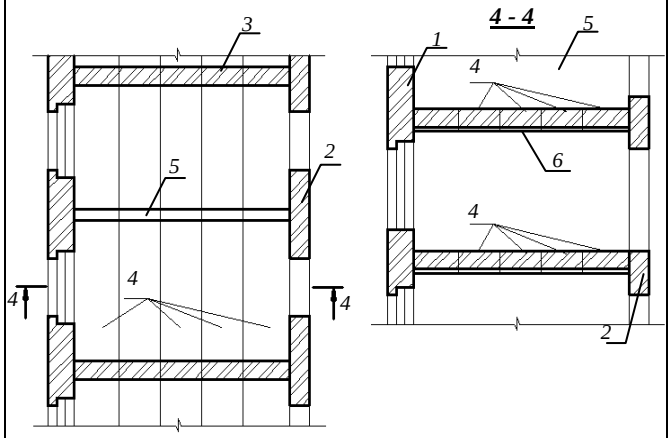
1 - floor slabs; *2* - cross bar; *3* - supporting frames with top principle reinforcement placed in slab cavities; *4* - mesh; *5* - grooves in slab flanges for placing frames and concrete; *6* - concrete; *7* - slab surface prepared for concreting (cleandowned and hacked

ARRANGEMENT OF INVERTED BEND IN STRENGTHENED SLAB BY MEANS OF AIR CUSHION



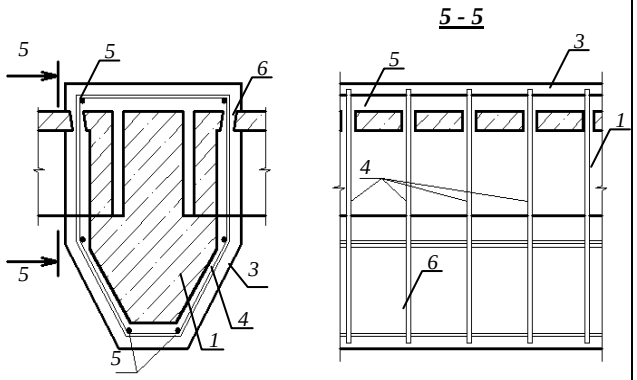
1 - air, cushion; *2* - protector; *3* - slab under strengthening; *4* - mesh; *5*- yokes; *6* - gripe; *7* - columns; *8* - air duct; *9* - new slab (should be concreted after formation of bend in existing slab (cushion should be removed after strengthening the concrete)

ENGAGEMENT OF FLOOR SLABS AND LOWER PARTITIONS INTO JOINT WORK



1 - external wall; *2* - internal wall; *3* - reinforced concrete key; *4* - reinforced concrete floor slabs; *5* - concrete or reinforced concrete partitions 80mm thick; brick partitions 120 mm thick; *6* - joint between partition and floor slabs caulked with 10MPa mortar

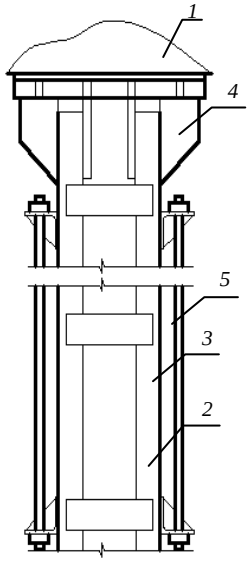
ARRANGEMENT OF REINFORCED CONCRETE YORE FOR ENGAGING FLOOR SLABS AND CROSS BARS INTO JOINT WORK



1 - floor slabs; *2* - cross bar; *3* - reinforced concrete yoke; *4* - lateral closed stirrups of yoke; *5* - longitudinal reinforcement of yoke; *6* - holes drilled in slab flanges for stirrups

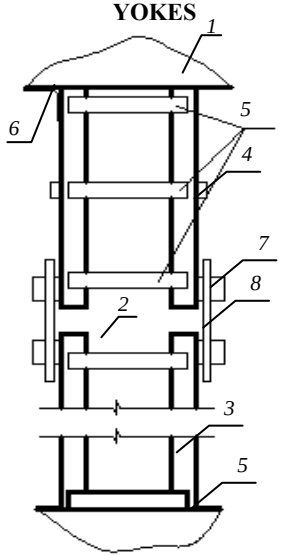
ENGAGEMENT OF STRENGTHENING MEMBERS INTO JOINT WORK

SETTING STRENGTHENING PRESTRESSED MEMBERS



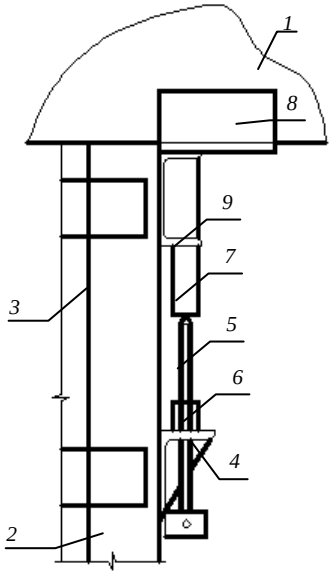
1 - beam; *2* - column; *3* - metal yoke; *4* – support portion of yoke; *5* - metal tension bars for yoke precompression (precompression streng-thening is controlled by dynamic analysis); *6*- yoke should be welded to upper and lower supporting portions and tension bars should be removed)

SETTING OF STAY BOLTS ON COMPOSITE METAL YOKES



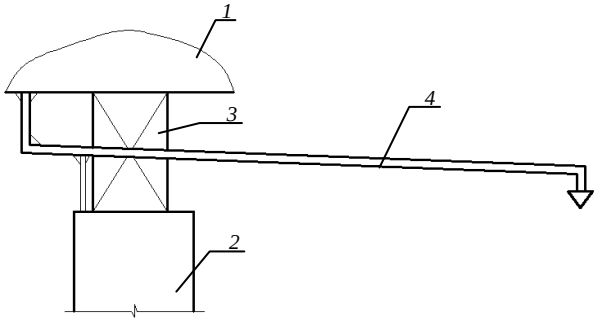
1 - beam; *2* - column; *3* - yoke angles (composite in height); *4* - cover plates placed before strengthening; *5* - cover plates placed after strengthening (assembling tension bars are present till strengthe-ning); *6* - supporting angles; *7* - cover plates made of angles and nuts in yoke joint; *8* - stay bolts

SETTING OF TENSION SCREW-TYPE THRUST MEMBER



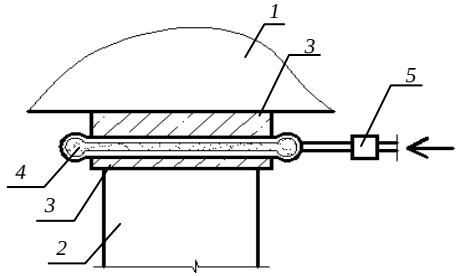
1 - structure under strengthening; *2* - column; *3* - column yoke; *4* - prop (to be removed after strengthening); *5* - tension screw; *6* - nut; *7* - dynamometer; *8* - pad; *9* - supporting member (after prestressing should be welded to yoke and pad)

SETTING OF LEVEL-TYPE THRUST MEMBER



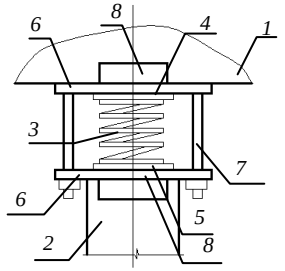
1 - structure under strengthening; *2* - additional support (column); *3* - rigid pads; *4* - level-type thrust member (to be removed after fixing the rigid pads

SETTING OF MEMBRANE THRUST PADS



1 - structure (cross-bar) under strengthening; *2* - additional support (column); *3* - pads; *4* - membrane thrust pad; *5* - pipe with pressure gauge; *6* - mortar (to be pumped under pressure and left till full hardening)

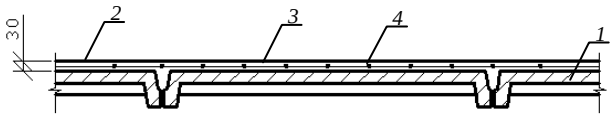
SETTING OF SPRING TYPE THRUST MEMBER



1 - structure under strengthening; *2* - additional relieving member (column); *3* - spring; *4* - disks; *5* - spherical bearings; *6* - thrust member bases; *7* - regulating ties (permit to transfer spring thrust stress through spherical bearings to strengthened member); *8* - fix-ing elements

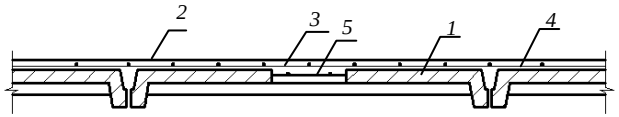
STRENGTHENING OF PRECAST REINFORCED CONCRETE RIBBED SLABS

SPLICING OF PRECAST RIBBED SLAB TOP PORTION IN CONDITIONS OF SUFFICIENT SURFACE BOND



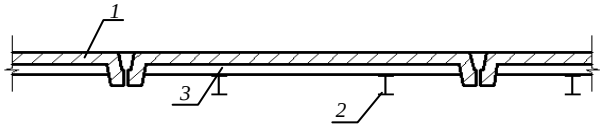
1 - slabs under strengthening; *2* - cast-in-place concrete layer; *3* - structural reinforcement of strengthening; *4* - cast-in-place concrete and slab bond surface

SPLICING OF PRECAST RIBBED SLAB TOP PORTION IN CONDITIONS OF INSUFFICIENT SURFACE BOND



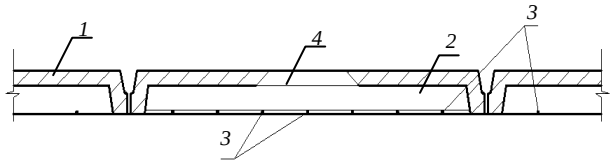
1 - slabs under strengthening; *2* - cast-in-place concrete layer; *3* - structural reinforcement of strengthening; *4* - cast-in-place concrete and slab bond surface; *5* - cut out areas of slab flanges with reinforcing fabrics retained

POSITIONING OF METAL RELIEVING BEAMS



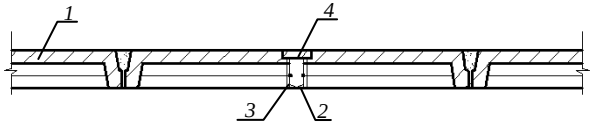
1 - slabs under strengthening; *2* - metal strengthening beams; *3* - metal plate-wedges engaging strengthening beams into work

STRENGTHENING OF PRECAST RIBBED SLABS IN CASE OF THEIR CONSIDERABLE DAMAGE



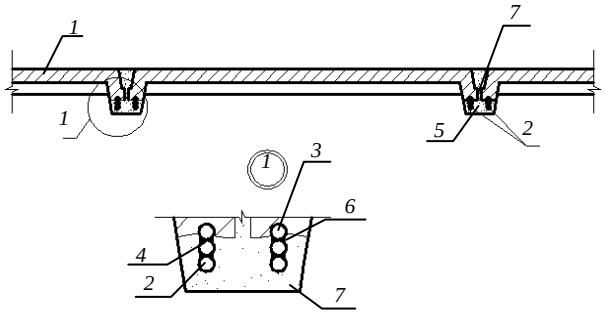
1 - slabs under strengthening; 2 - cast-in-place concrete; 3 -principal reinforcement of strengthening; 4 - cut out areas of slab flanges for placing concrete

POSITIONING OF CAST-IN-PLACE CONCRETE RIBS



1 - slabs under strengthening; 2 - cast-in-place reinforcing concrete rib; 3 - reinforcing cage of strengthening rib; 4 - cut out holes in slab flange (with reinforcing fabrics retained) for placing concrete

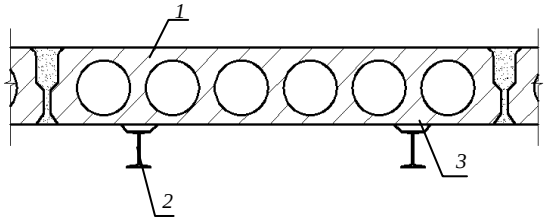
PLACING OF ADDITIONAL PRINCIPAL REINFORCEMENT



1 - slabs under strengthening; *2* - additional reinforcement; *3* - slab reinforcement exposed at 100mm long sections spaced at 1.0 m; *4* - short reinforcing rods 80 to 100 mm long; *5* - concrete or mortar; *6* - welding; *7* - antirust paint

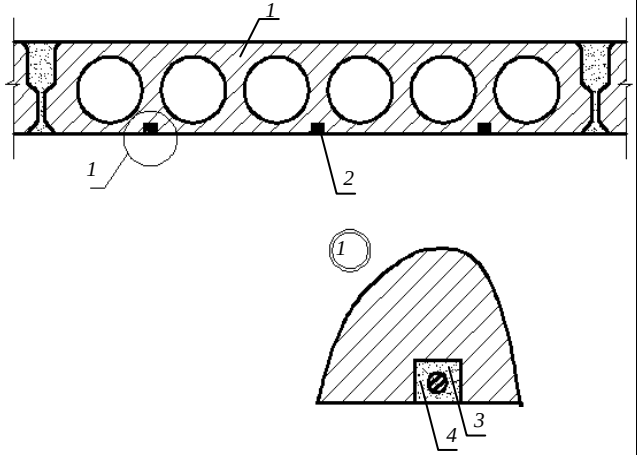
STRENGTHENING OF FLOOR SLABS IN LARGE PANEL STRUCTURES

POSITION OF METAL RELIEVING BEAMS FROM BELOW



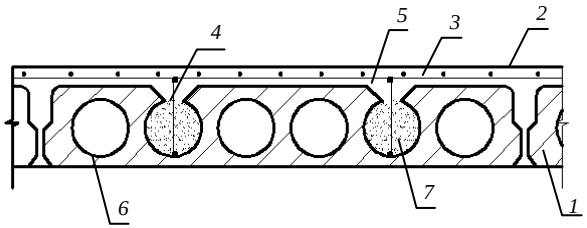
1 - slabs under strengthening; *2* - metal strengthening beams; *3* -joint between slabs and relieving beams wedged out by metal plates at every 500 mm and caulked in by cement-sand mortar

SETTING OF ADDITIONAL REINFORCEMENT BY USING POLYMER MORTAR



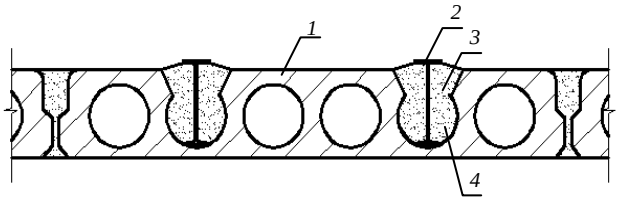
1 - slabs under strengthening; *2* - additional reinforcement; *3* - grooves milled in concrete; *4* - protective-structural polymer mortar

SPLICING OF SLAB TOP PORTION IN CONDITIONS OF INSUFFICIENT SURFACE BOND



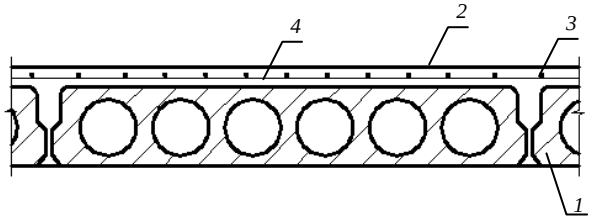
1 - slabs under strengthening; *2* - cast-in-place concrete layer; *3* - structural reinforcement of strengthening; *4* - reinforcing cages of strengthening; *5* - cut out slab flanges in sections of placing rein-forcing cages; *6* - cast-in-place concrete and slab bond surface; *7* - concrete for cavities grouting

POSITION OF METAL RELIEVING BEAMS FROM ABOVE



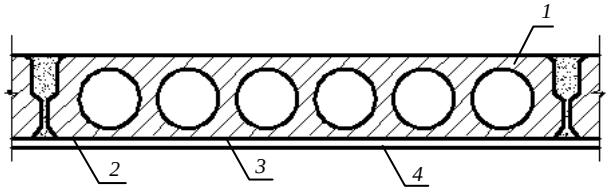
1 - slabs under strengthening; *2* - metal strengthening beams; *3* - cut out slab flanges(along the whole length) for placing strengthe-ning beams; *4* - concrete for grouting cavities and cut out flanges

SPLICING OF SLAB TOP PORTION IN CONDITIONS OF SUFFICIENT SURFACE BOND



1- slabs under strengthening; *2* - cast-in-place concrete layer; *3* – structural reinforcement of strengthening; *4* - cast-in-place concrete and slab bond surface

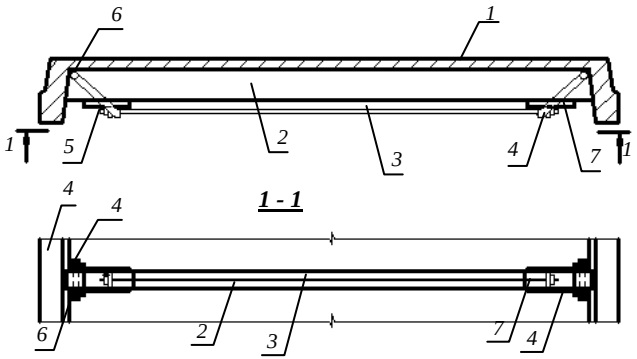
GLUEING OF GLASS CLOTH OR SHEET METAL BY USING POLYMER MORTAR



1- slabs under strengthening; *2* - cleaned and degreased slab surface; *3* - protective-structural polymer mortar; *4* - shett metal or several layers of glass cloth

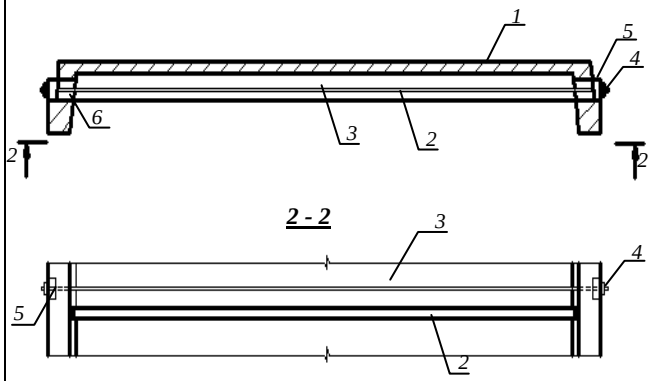
STRENGTHENING OF REINFORCED CONCRETE ROOF SLABS

SETTING OF STRUTTED TIES ON CROSS RIBS



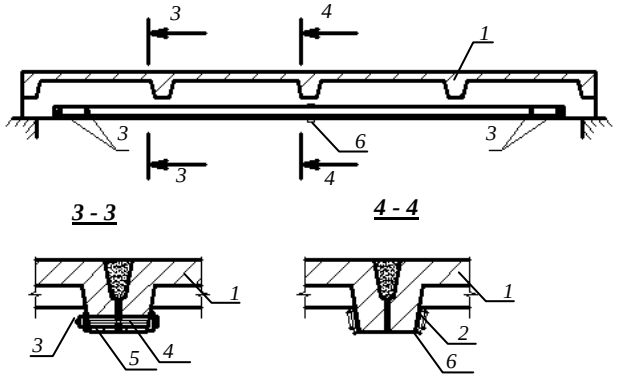
1 - roof slab; *2* - slab cross ribs to be strengthened; *3* - horizontal section of reinforcing steel strutted tie; *4* - sloping sections of strip steel strutted tie; *5* - tension nuts; *6* - anchor bolts of strutted tie set in drilled holes; *7* - bearing plates

SETTING OF PRESTRESSED TIES ON CROSS RIBS



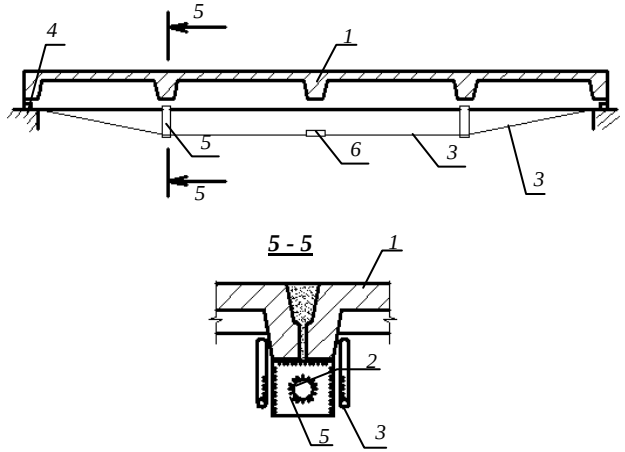
1 - roof slab; *2* - cross slab ribs to be strengthened; *3* - reinfoircing steel prestressed ties; *4* - tension nuts; *5* - washers; *6* - holes drilled in slab longitudinal ribs

SETTING OF STEEL STRIP TIES



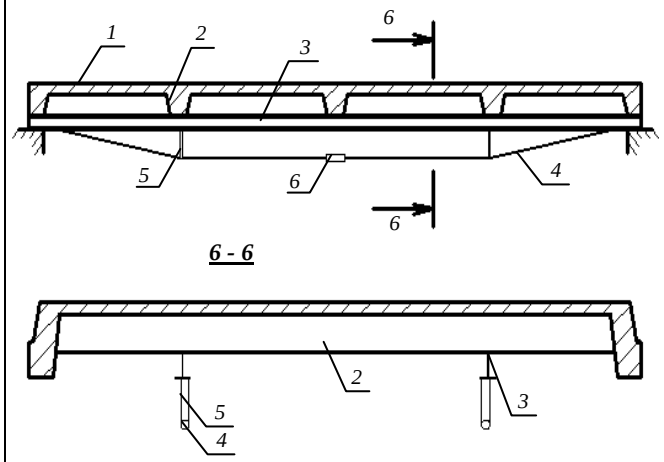
1 - slabs under strengthened; *2* - steel strip ties; *3* - coupling bolts; *4* - holes for bolts drilled in slab longitudinal ribs (above the prin-ciple reinforcement); *5* - steel plate-wedges in bolt and wedge fixing points in interslab joints; *6* - plate-wedges for engaging ties into joint work

SETTING OF STRUTTED BEAMS



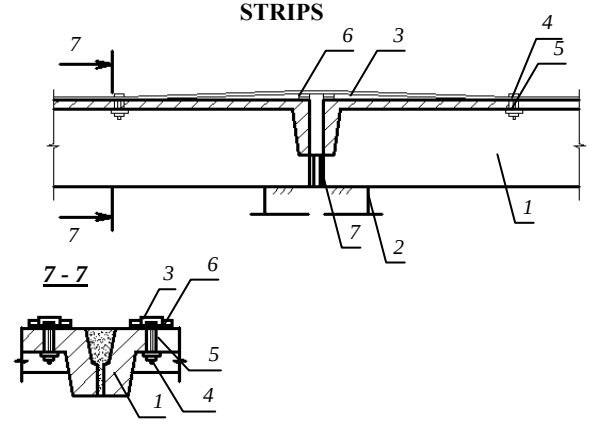
1 - roof slabs to be trengthened; *2* - horizontal section of reinforcing steel strutted tie; *3* - sloping sections of reinforcing steel strutted tie; *4* - strutted tie anchors; *5* - struts; *6* - turnbuckle

POSITIONING OF STRUTTED BEAMS



1 - roof slab; *2* - slab cross rib; *3* - the upper chord of double-tee strutted beam; *4* - reinforcing steel strutted beam tie; *5* - channel struts; *6* - turnbuckle

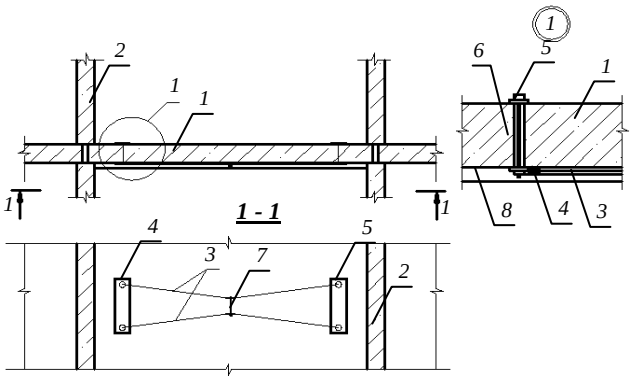
ENSURING OFCONTINUITY BY MEANS OF STEEL STRIPS



1 - slabs under strengthened; *2* - rafter structures; *3* - steel strip providing slab continuity; *4* - coupling bolts; *5* - holes for coupling bolts in slab flange; *6* - plate-wedges for engaging steel strips into work; *7* - joint between longitudinal rib butts wedged out by steel plates

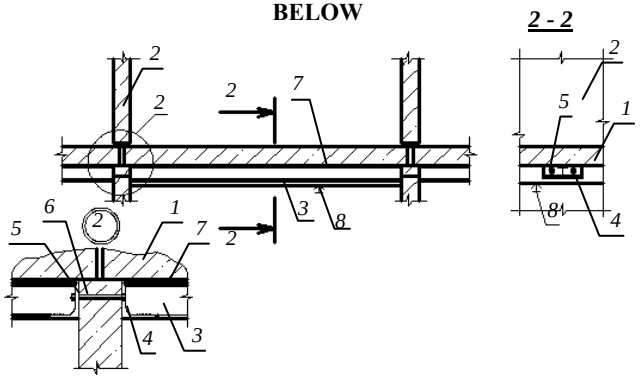
STRENGTHENING OF FLOOR SLABS IN LARGE PANEL STRUCTURES

SETTING OF STRUTTED TIES



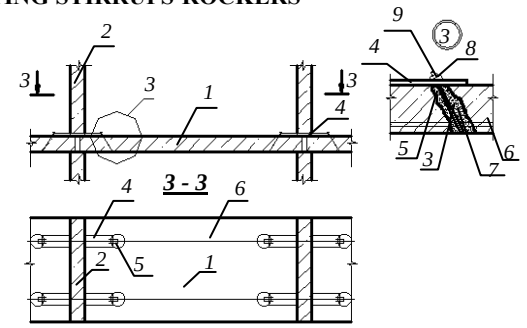
1 - floor slab under strengthening; *2* - concret bearing walls; *3* - reinforcing steel ties welded to plates; *4* - metal plates bolted to slab; *5* - fastening bolts; *6* - slab holes for bolts; *7* - cramps for stressing operations in ties; *8* - plastering of boarded ceiling

PLACING OF RELIEVING METAL BEAMS FROM BELOW



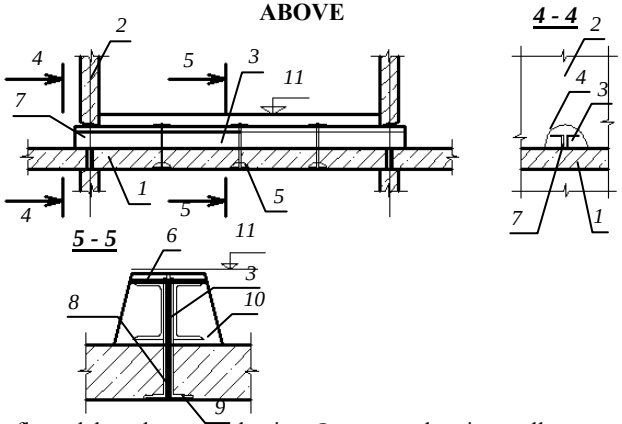
1 - floor slab under strengthening; *2*-concret bearing walls; *3*- doubletee relieving beam with cuts on supports to rest on angle props; *4* - angle support props; *5* - suscoupling bolts; *6* - wall holes for bolts; *7* - joint between strengthening slab and relieving beams wedged out by metal plates (to be caulked by cement-sand mortar); *8* - new boarded ceiling mark

ACHIEVING CONTINUITY OF FLOOR SLAB BY SETTING STIRRUPS-ROCKERS



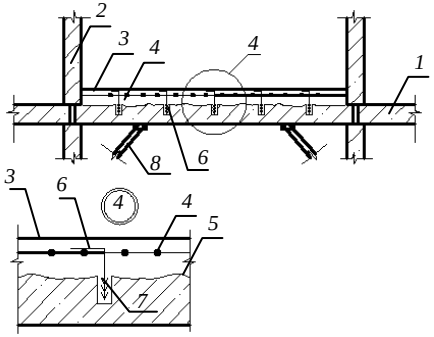
1 - floor slab under strengthening; *2* - concret bearing walls; *3* - anchor stirrups set in holes cut out in slab (they ring out principle reinforcement) and fastened to plate-rockers; *4* - plate-rockers (with holes for anchor stirrups) passed through wall panel joints; *5* - holes in slabs for anchor stirrups (in principle reinforcement zone); *6* - principle reinforcement of slab; *7* - grouting concrete; *8* - diagonal washers; *9* - tension nuts

PLACING OF RELIEVING METAL BEAMS FROM ABOVE



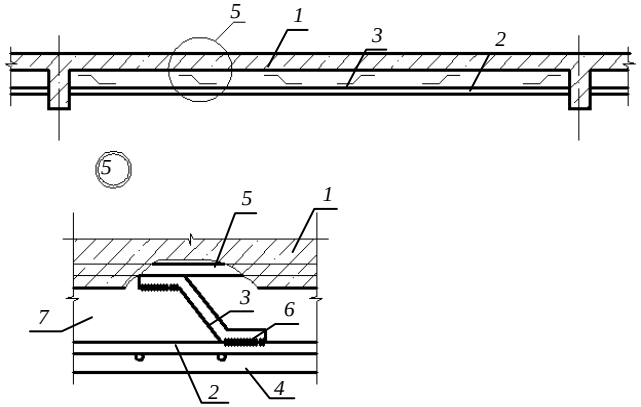
1 - floor slab under strengthening; *2* - concret bearing walls; *3* - coupled channel relieving beam; *4* - wall holes for placing the beams; *5* - suspenders in the form of tension bars with washers and nuts; *6* - cross planks; *7* - bearing plates; *8* - hols for tension bars; *9* - recesses for washers; *10* - concreting ofstrengthening beams; *11* - new floor elevation

FLOR SLAB CAST-IN-PLACE CONCRETE SPLICING FROM ABOVE



1-floor slab under strengthening; *2* - concret bearing walls; *3*- upper reinforced concrete splice; *4* - reinforcing fabric of splice; *5* - slab surface prepared for concreting (cleandowned and hacked); *6* -additional Γ-shaped anchor ties of periodical profile reinforcement set by means of cement-sand mortar in drilled bores; *7* - bores for anchor ties spaced at 1.0 m; *8* - temporary sub-struts for eliminating streng-thened beam deflection (to be removed after concrete gaining 70% design strength)

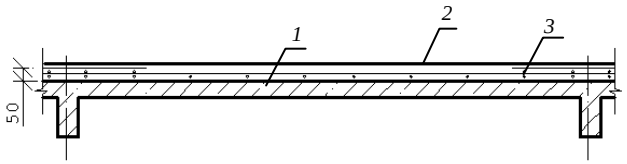
SPLICING OF BOTTOM PORTION OF CAST-IN-PLACE SLABS



1 - slab under strengthening; *2* - principle reinforcement of strengthening; *3* - bent reinforcement bars; *4* - gunite of strengthening; *5* - cut protective concrete layer; *6* - welding; *7* - bottom pertion of slab surface prepared for concreting

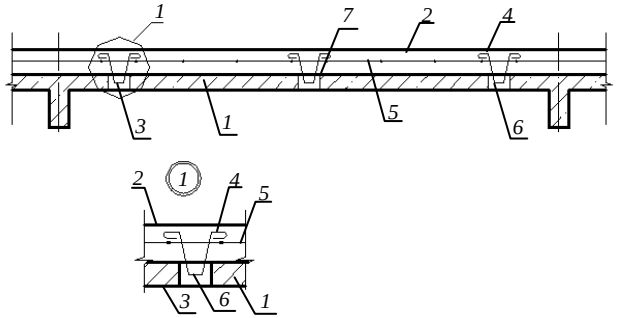
STRENGTHENING OF CAST-IN-PLACE CONCRETE SLABS

SPLICING OF CAST-IN-PLACE SLABS IN CONDITIONS OF INSUFFICIENT SURFACE BOND



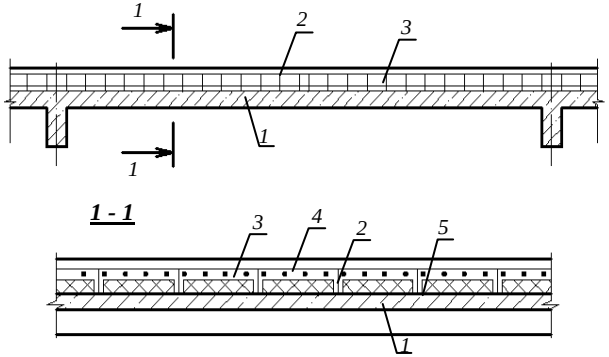
1 - slab under strengthening; *2* - cast-in-place concrete layer; *3* - span and support principle reinforcement of strengthening

SPLICING OF TOP PORTION BY MEANS OF REINFORCED CONCRETE KEYS



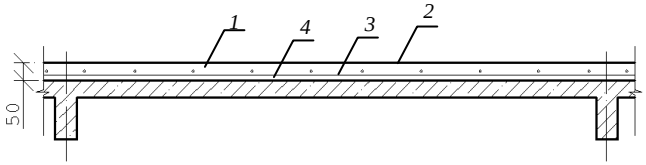
1 - slab under strengthening; *2* - top splice; *3* - reinforced concerte keys; *4* - A-I class reinforcement bent pieces; *5* - reinforcing fabric of splice; *6* - 100x100 mm holes spaced in chess-board order at 500 to 700 mm in the slab; *7* - slab surface prepared for concreting (cleandowned and hacked)

SPLICING OF SLAB TOP PORTION IN THE FORM OF RIBBED SLAB



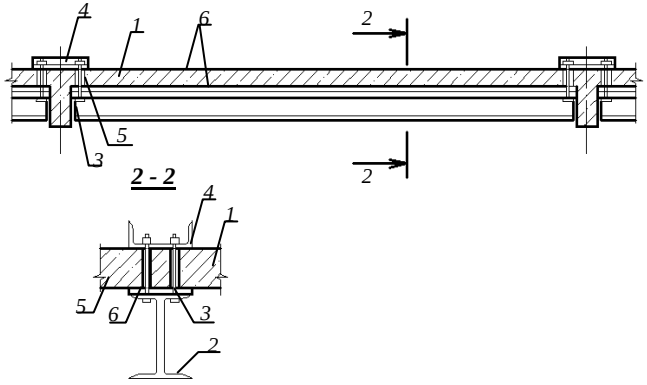
1 - slab under strengthening; *2* - cast-in-place ribbed slab of splice; *3* - reinforcing cages of splice; *4* - reinforcing fabrics of splice; *5* - core former (foamed plastics, foamed polystyrene and others)

SPLICING OF CAST-IN-PLACE SLAB TOP PORTION IN CONDITIONS OF SURFACE BOND



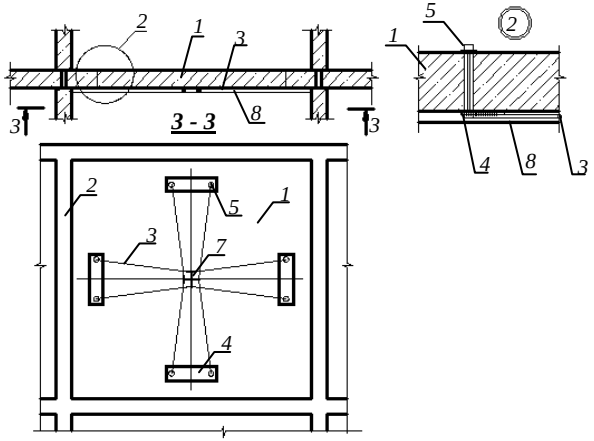
1 - slab under strengthening; *2* - cast-in-place concrete layer; *3* - struc-tural reinforcement; *4* - bond surface of cast-in-place concrete and slab (clean downed, hacked, washed by water, etc.)

POSITIONING OF METAL RELIEVING BEAMS FROM BELOW



1 - slab under strengthening; *2* - metal relieving beam; *3* - high strength bolts for fixing the beams; *4* - channel-type pad-washers; *5* - holes drilled in slab; *6* - plate-wedges engaging relieving beams into work

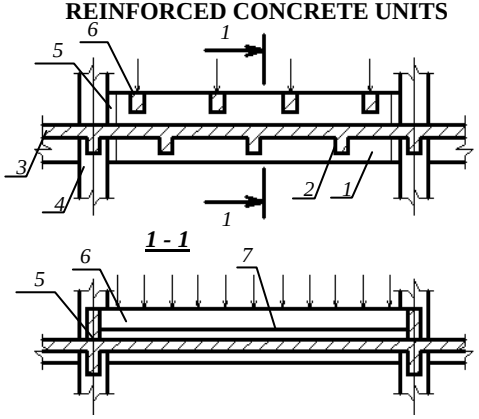
SETTING OF STRUTTED TIES IN CONTOUR SUPPORTED SLABS



1 - contour supported floor slab under strengthening; *2* - concret bearing walls; *3* - reinforcing steel ties welded to plates; *4* - anchor plates bolted to slab; *5* - anchor bolts; *6* - slab holes for bolts; *7* - cramps for stressing operations in ties; *8* - cement-sand plastering of boarded ceiling

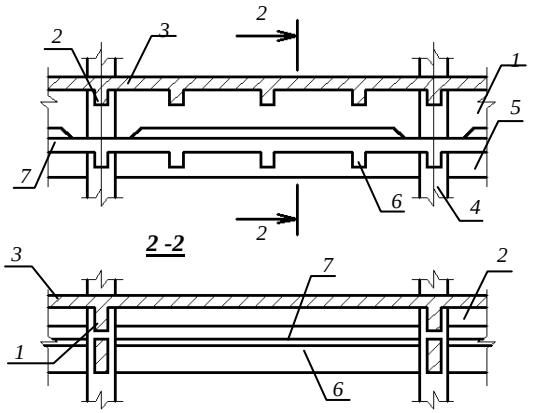
STRENGTHENING OF CAST-IN-PLACE REINFORCED CONCRETE FLOORS

PARTIAL UNLOADING OF FLOORS BY USING REINFORCED CONCRETE UNITS



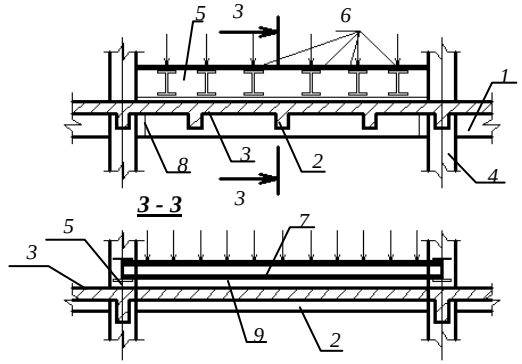
1 - main beam of existing floor; *2* - secondary beams of existing floor; *3* - slab of existing floor;*4*-column of existing frame; *5*-main relieving beams put on the floor and braiced with main beams by stirrups; *6* - secondary relieving beams with clearance above the floor; *7* - clearance between relieving beams and floor; *8* - bands

REPLACING OF EXISTING FLOOR



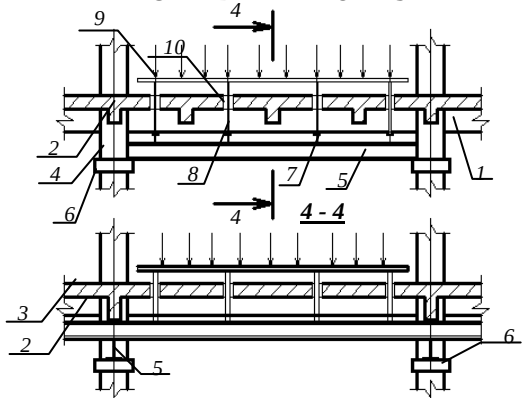
1 - main beams of new floor; *2* -secondary beams of the new floor; *3* - slab of new floor; *4* - column of existing frame (to be preserved); *5* - main beams of existing floor (to be preserved); *6* - secondary beams of existing floor (to be dismanteled); *7* - slab of existing floor (to be dismanteled)

FULL UNLOADING OF FLOOR TOP BY USING ROLLED METAL UNITS



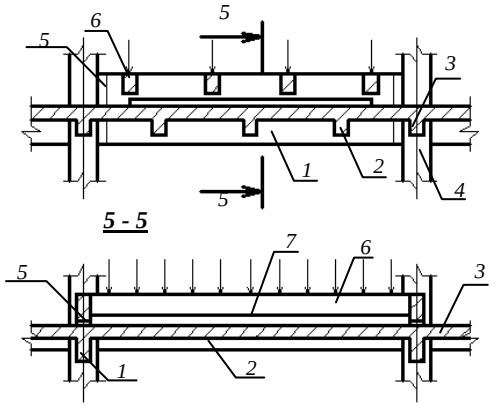
1 - main beams of existing floor; *2* - secondary beams of existing floor; *3* - slab of existing floor; *4* - column of existing frame; *5* - main relieving double-tee beams with the clearance above the floor; *6* - secondary relieving beams with clearance above the floor; *7* - bearing pads; *8* - fastening bolts; *9* - clearance between relieving beams and floor;

FULL UNLOADING OF FLOOR BOTTOM BY USING ROLLED METAL UNITS



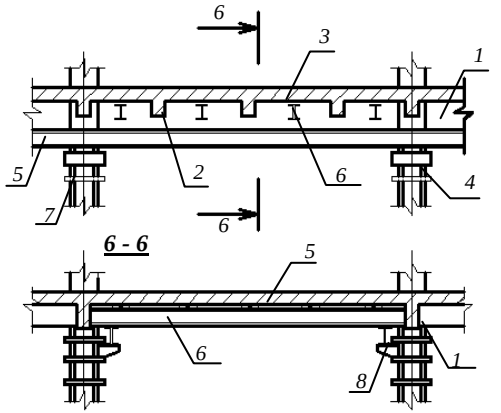
1 - main beams of existing floor; *2* - secondary beams of existing floor; *3* - slab of existing floor; *4* - column of existing frame; *5* - main relieving double-tee beams; *6* - bearing props in the form of reinforced concrete or metal yokes around columns; *7* – secondary relieving double-tee beams;*8* - double-tee posts; *9* - double-tee deck for taking the equipment load; *10* - holes for posts in the slab

FULL UNLOADING OF FLOORS BY USING REINFORCED CONCRETE UNITS



1 - main beams of existing floor; *2* - secondary beams of existing floor; *3* - slab of existing floor; *4* - column of existing frame; *5* - main relieving beams with clearance above the floor; *6* - secondary relieving beams with clearance above the floor; *7* - clearance between relieving beams and floor;

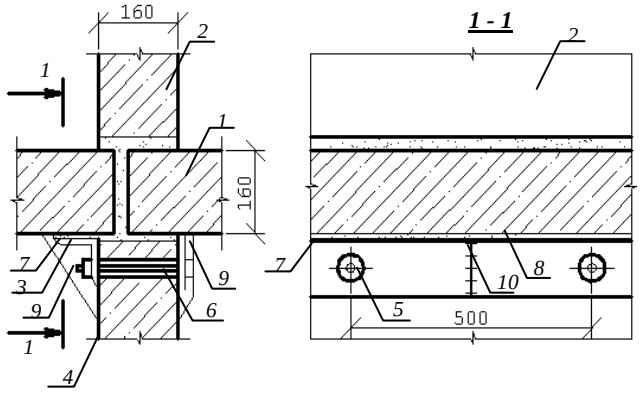
POSITIONING OF OF ROLLED METAL BEAM CAGE



1 - main beams of existing floor; *2* - secondary beams of existing floor; *3* - slab of existing floor; *4* - columns of existing frame; *5* - main beams of double-tee cage; *6* - secondary beams of double-tee cage; *7* - metal yoker aroung columns; *8* -metal cantilievers; *9* - plate-wedges for engaging the beam cage into work

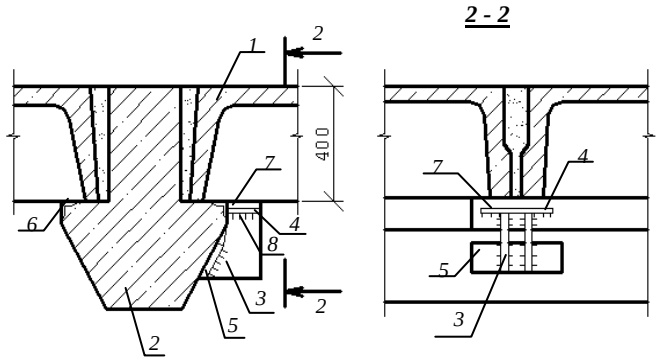
STRENGTHENING OF BEARING UNITS OF FLOOR SLABS

POSITIONING OF PROPS ON BOLTS



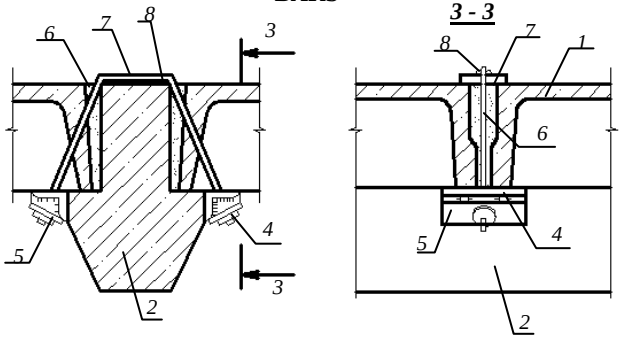
1 - displaced panels; *2* - bearing concrete panels; *3* - displaced panel wide angle props; *4* - 14 mm diameter holes in concrete panel; *5* - M12 bolts spaced at 500 mm; *6* - plate- washer; *7* - wedging out by plates; *8* - caulking by 1OMPa grout; *9* - plastering on mesh; *10* - stiffening ribs spaced at 500 mm

POSITIONING OF PROPS BY WELDING WITH CAST-IN ITEMS



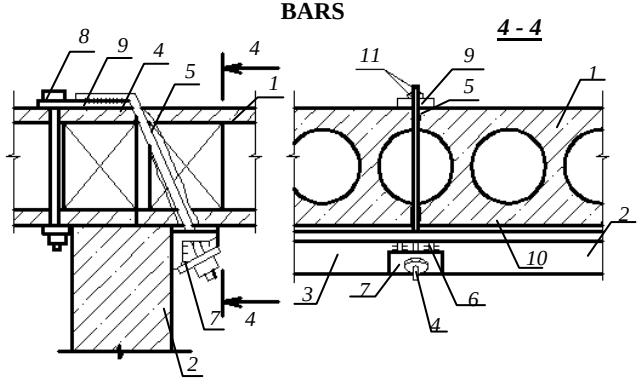
1 - displaced panels; *2* - cross-bar; *3* - prop vertical ribs; *4* - prop horizontal flange; *5* - prop back bearing, plate; *6* - cross bar cast-in item; *7* - plate-wedges for engaging the prop into work; *8* - welding

POSITIONING OF PROPS BY MEANS OF TENSION BARS



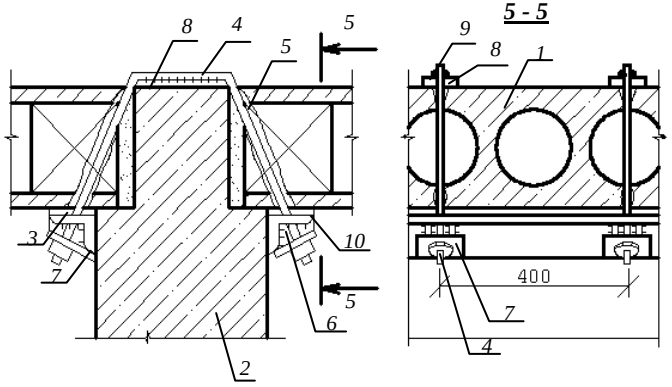
1 - displaced panels; *2* - cross-bar; *3* - angle-prop; *4* - stiffening ribs; *5* - bearing plate-washer; *6* - tension bars with nuts set in interpanel joints (nuts should be tightened for engaging props into work and welded); *7* - plate-pad under tension bars; *8* - welding

POSITIONING OF PROPS BY MEANS OF TENSION BARS



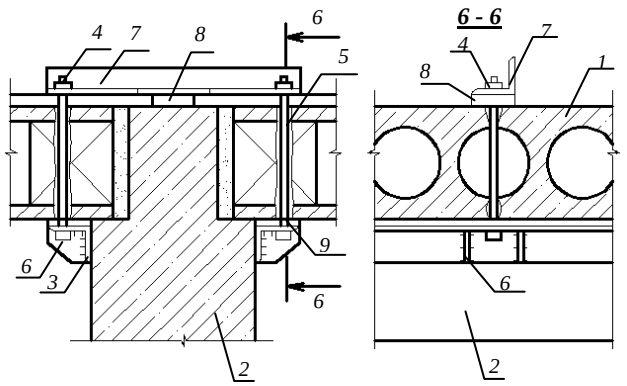
1 - displaced panel; *2* - cross bar; *3* - panel wide angle prop; *4* -tension bars with nuts spaced at 400 mm (nuts should be tightened and welded); *5* - holes in panel flanges and concrete corks; *6* - stiffening ribs; *7* - bearing plate-washers; *8* - fastening bolts; *9* - plate for fas-tening the tension bar; *10* - leveling grout course; *11* - welding

POSITIONING OF PROPS BY MEANS OF TENSION BARS



1 - displaced panel; *2* - cross-bar; *3* - panel wide angle prop; *4* - tension bar with nuts (nuts should be tightened and welded); *5* - holes in panel flanges and concrete corks; *6*- stiffening ribs; *7* - bearing plate-washers; *8* - plate-pad under tension bars; *9* - welding; *10* - leveling grout course

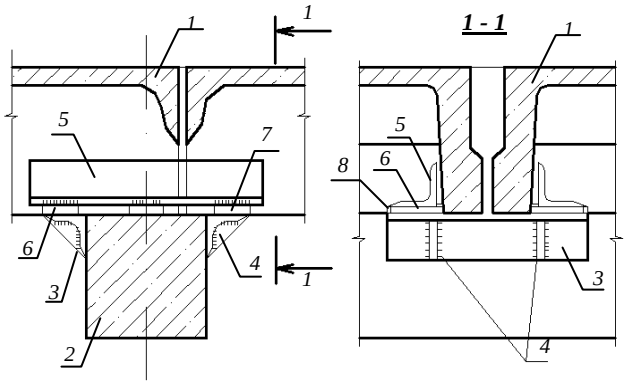
POSITIONING OF PROPS BY MEANS OF BOLTS



1 - displaced panel; *2* - cross-bar; *3* - panel wide angle prop; *4* - tension bars with nuts spaced at 400 mm (nuts should be tightened and welded); *5* - holes in panel flanges and concrete corks; *6* - stiff-ening ribs; *7* - angle-rocker; *8* - aligning plate (can be used for wedging); *9* - leveling grout course

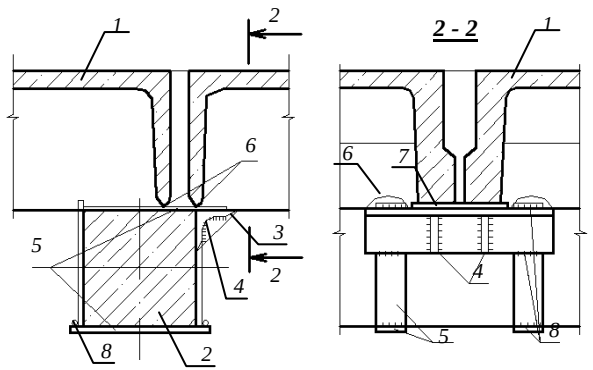
STRENGTHENING OF BEARING UNITS OF ROOF PANEL

POSITIONING OF PROPS BY MEANS OF JIGS



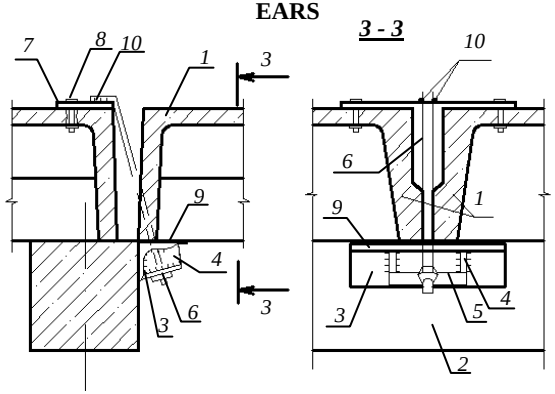
1 - displaced panels; *2* - bearing roof lement(truss, beam); *3*- angle-prop; 4 - stiffening ribs; *5* - prop jig; *6* - plate-pads; *7* - plate-wedges (aligning planks); *8* - welding

POSITIONIHG OF PROPS BY MEANS OF STIRRUPS



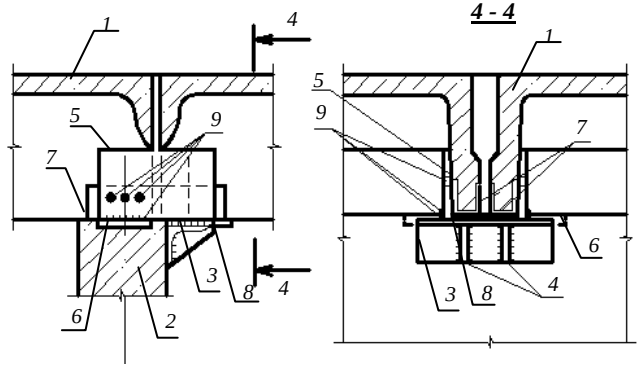
1 - displaced panels; *2* - bearing roof element (truss, bean); *3* - angle-prop; *4* - stiffening ribs; *5* - stirrup planks; *6* - holes cut out in panel butt ribs (to *be* concreted after strengthening); *7* - plate-wedges for engaging props into joint work; *8* - welding

POSITIONING OF PROPS BY MEANS OF TENSION EARS



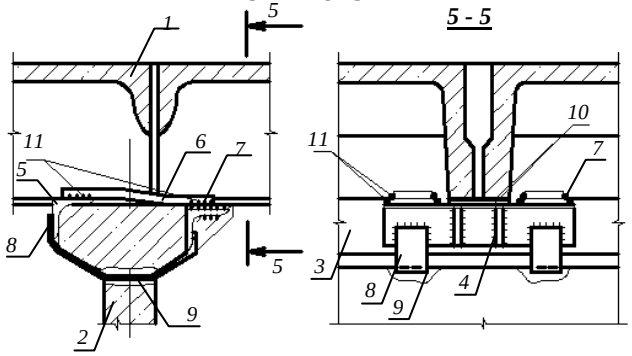
1 - displaced panels; *2* - bearing roof element (truss, beam); *3* - angle-prop; *4* - stiffening ribs; *5* - bearing washes for nut; *6* - tension bar with nut; *7* - plate for tension bar fastening; *8* - fastening bolts; *9* - plate-wedges for engaging the prop into work; *10* - welding

POSITIONIHG OF PROPS BY MEANS OF WELDING WITH CAST-IN ITEMS



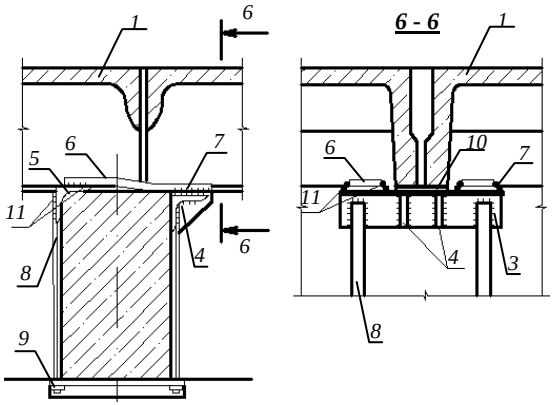
1 - displaced panels; *2* - bearing roof element (truss, beam); *3* - angleprop plate jig with holles for welding; *4* - roof element; *5* - cast-in item; *6* - scab; *7* - panel cast-in items; *8* - plate wedges for engaging the prop into work; *9* - welding

POSITIONING OF PROPS BY MEANS OF BRACES-STIRRUPS



1 - displaced panels; *2* - double-tee (tee) section roof beams; *3* - angle-prop; *4* - stif-fening ribs; *5* - fastening angle with flange notch in intersection with panel ribs; *6* - scab; *7* - pad; *8* - lower brace-stirrup; *9* - holes in beam web (to be caulked by concrete after setting the stirrups; *10* - plate-wedges for engaging the prop into work*; 11* - welding

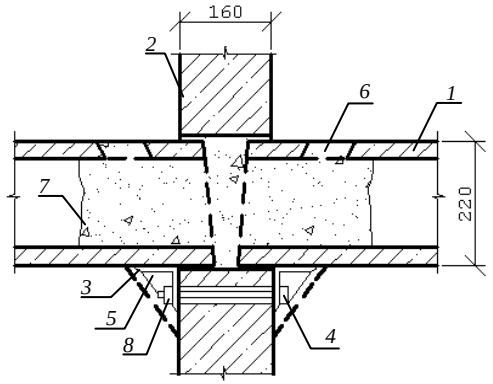
POSITIONING OF PROPS BY MEABS OF COUPLING BOLTS



1 - displaced panels; *2* - roof beam (frame); *3* - angle prop; *4* - stif-fening ribs; *5* - fastening angle with panel ribs; *6* - scab; *7* - pad; *8* - coupling bolts; *9* - coupling bolts angle-washers; *10* - plate-wedges for engaging the prop into work; *11* - welding

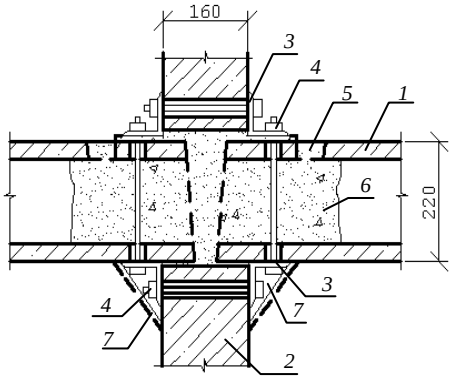
STRENGTHENING OF PLATFORM BUTT JOINTS OF LARGE-PANEL BUILDINGS

STRENGTHENING OF FLOOR SLAB SUPPORT UNITS



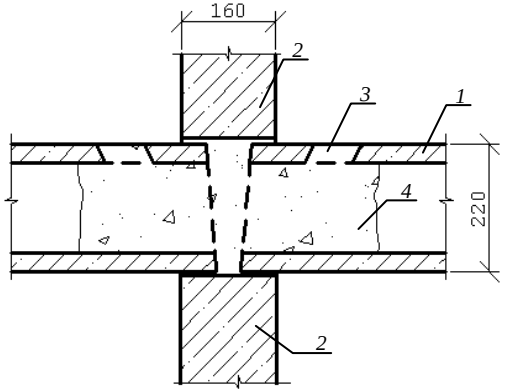
1 - core floor slabs with little support by walls; *2* - concrete wall panels; *3* - additional angle supports; *4* - coupling bolts spaced at 600 mm in drilled holes; *5* - stiffening ribs; *6* - holes in slab flanges for placing concrete; *7* - concrete anchor blocks in every third core; *8* - plastering on mesh

STRENGTHENING OF FLOOR SLAB AND WALL SUPPORT UNITS



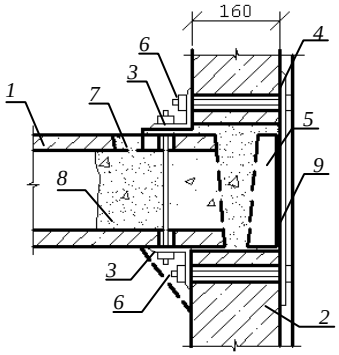
1 - core floor slabs with little support by walls; *2* - concrete wall panels with decreased concrete, strength; *3* - additional angle supports; *4* - coupling bolts spaced at 600 mm drilled holes; *5* - holes in slab flanges for placing concrete; *6* - concrete anchor blocks in every third core; *7* - plastering on mesh

STRENGTHENING OF FLOOR SLAB SUPPORT SECTIONS



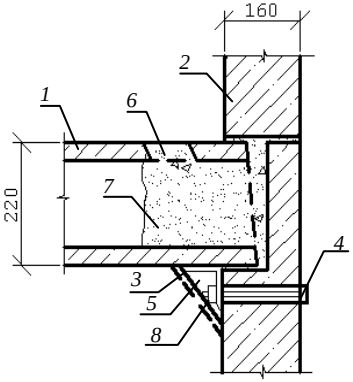
1- core floor slabs without concrete anchor blocks in support sections; *2* - concrete wall panels; *3* - holes in slab flanges for placing concrete; *4* - concrete anchor blocks in every third core

STRENGTHENING OF FLOOR SLAB AND WALL SUPPORT UNITS



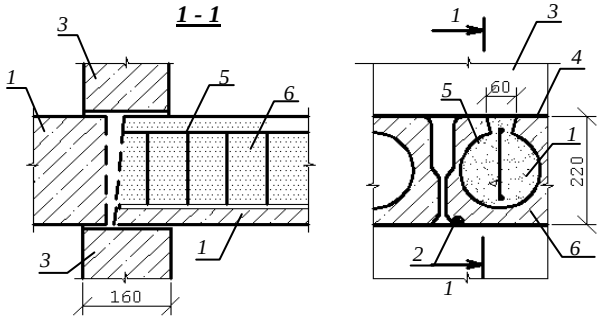
1 - core floor slab with little support by the wall; *2* - wall panels with spalls in concrete; *3* - additional angle supports; *4* - metal sheet cover plate; *5* - angle stiffening ribs welded to sheet; *6* - coupling bolts spaced at 600 mm In drilled holes; *7* - holes in slab flanges for placing concrete; *8* - concrete anchor blocks in every third core; *9* - plastering on mesh

STRENGTHENING OF FLOOR SLAB SUPPORT UNITS



1 - core floor slab with little support by the wall; *2* - concrete wall panels; *3* - additional angle support; *4* - coupling bolts spaced at 600 mm in drilled holes; *5* - stiffening ribs; *6* - holes in slab flanges for placing concrete; *7* - concrete anchor blocks in every third core; *8* - plastering on mesh

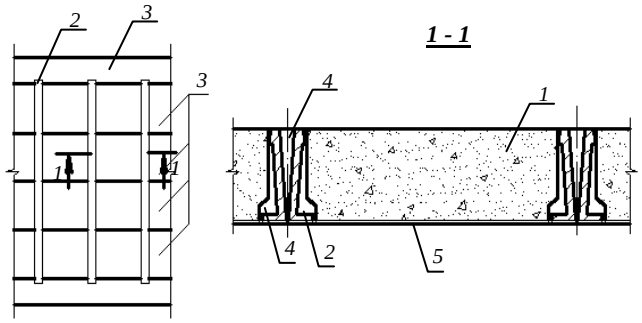
STRENGTHENING OF FLOOR SLAB SUPPORT SECTIONS IN CASE OF ANCHOR FAILURE OR PRINCIPLE REINFORCEMENT RUPTURE



1 - core floor slabs; *2* - panel principle reinforcement with failures in anchorage or rupture in support; *3* - wall panels; *4* - hole cut out in slab flange for fixing the reinforcing cage and placing concrete; *5* - reinforcing cage; *6* - grouting concrete at the place of cage fixing

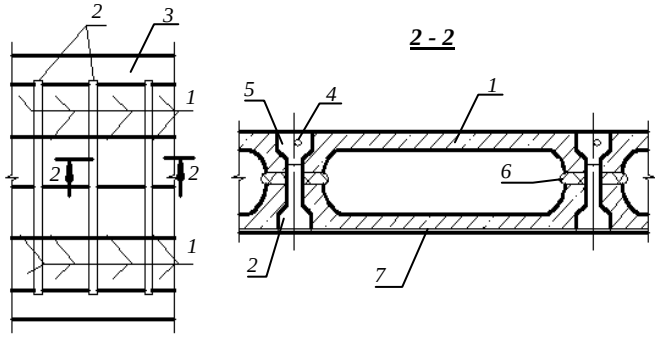
ARRANGEMENT OF FLOORS FROM SMALL-SIZED REINFORCED CONCRETE MEMBERS IN RECONSTRUCTING BUILDINGS AND STRUCTURES

SETTING OF SOLID INSERTS CLOSE TO REINFORCED CONCRETE BEAMS



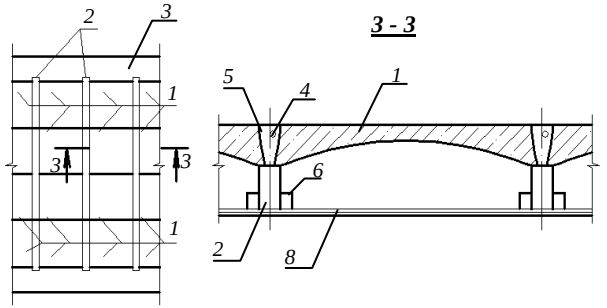
1 - cellular concrete solid inserts resting on reinforced concrete beams; *2* - reinforced concrete beams in the form of channels with inclined wall (with support in brick wall recesses); *3* - brick wall; *4* - grouting concrete; *5* - plaster

SETTING OF RIBBED INSERTS CLOSE TO REINFORCED CONCRETE BEAMS



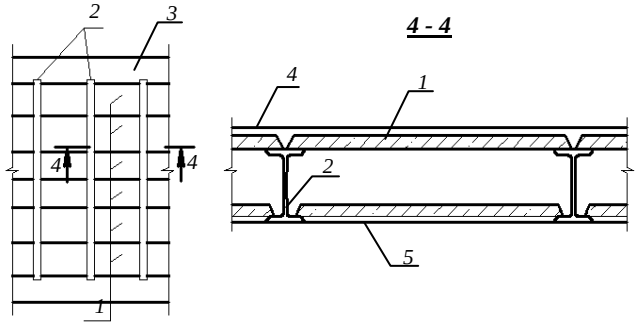
1 - lightweight concrete ribbed inserts resting on reinforced concrete beams; *2* - reinforced concrete beams with support in brick wall recesses; *3* - brick walls; *4* - reinforcing cages protruding from beams; *5* - grouting concrete; *6* - sound insulation pads;*7* - plaster

SETTING OF VAULTED INSERTS ON REINFORCED CONCRETE BEAMS



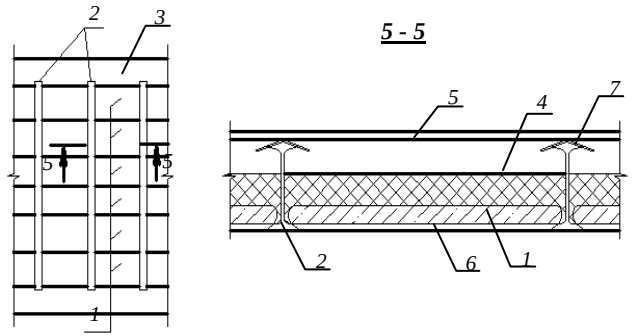
1 - vaulted lightweight concrete inserts resting on reinforced concrete beams; *2* - reinforced concrete beams with support in brick wall recesses; *3* - brick walls; *4* - reinforcing cages protruding from beams; *5* - grouting concrete; *6* - ledgers attached to beams; *7* - boarded ceiling; *8* - plastering or sheet material finishing

SETTING OF FLAT REINFORCED CONCRETE SLABS ON METAL BEAMS



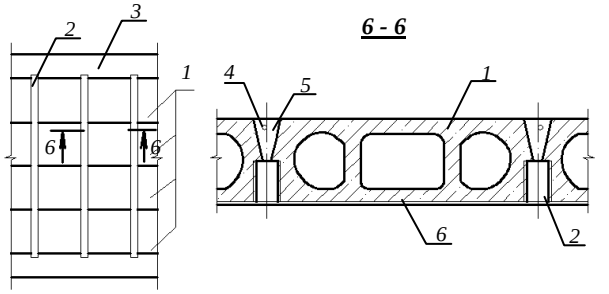
1 - flat reinforced concrete slabs resting on upper and lower flanges of metal beams; *2* - double-tee metal beams with support in brick wall recesses; *3* - brick walls; *4* - floor system; *5* - plaster

SETTING OF FLAT REINFORCED CONCRETE SLABS ON METAL BEAMS



1 - flat reinforced concrete slabs resting on lower flanges of metal beams; *2* - double-tee metal beams with support in brick wall recesses; *3* - brick walls; *4* - warmth-keeping (sound insulation) filling; *5*- floor system; *6* - plaster; *7* - bituminous felt

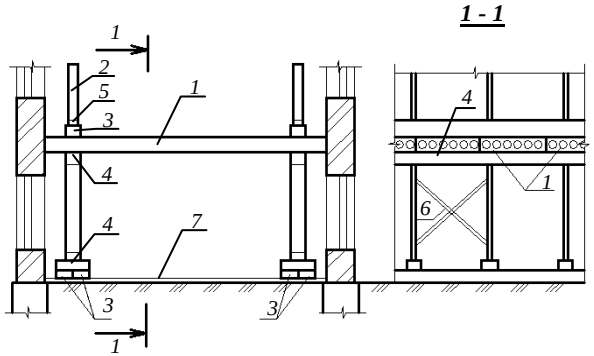
SETTING OF HOLLOW BLOCKS CONCRETE BEAMS



1 - lightweight concrete hollow blocks resting on reinforced concrete beams; *2* - reinforced concrete beams with support in brick wall recesses; *3* - brick walls; *4* - reinforcing cages protruding from beams; *5* - grouting concrete; *6* - plaster

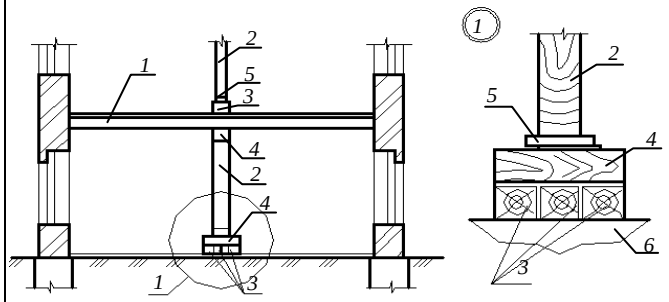
WAYS OF TEMPORARY STRENGTHENING REINFORCED CONCRETE FLOOR SLABS

POSITIONING OF POSTS NEAR SUPPORTS



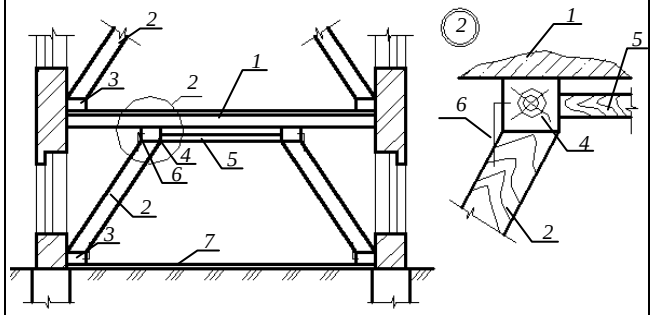
1- reinforced concrete floor slabs to be strengthened; *2*- relieving metal or wooden posts; *3*- square-sawn timber ground beams; *4*- square-sawn timber pads; *5*- wedges for engaging the posts into work; *6*- braces; *7*- the floor of the building

POSITIONING OF POSTS IN THE MIDDLE OF THE SPAN



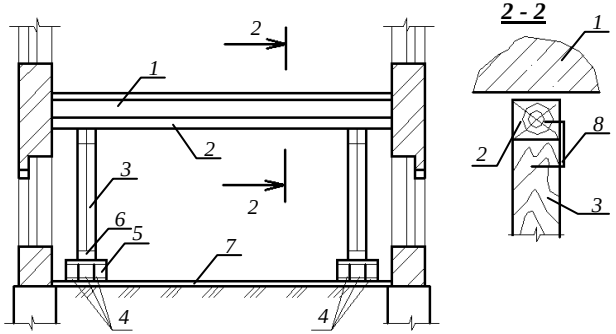
1 - reinforced concrete floor slabs to be strengthened; *2* - relieving metal or wooden posts; square-sawn timber ground beams; *3*- square-sawn timber pads; *4* - wedges for engaging the posts into work; *5* - the floor of the building

POSITIONING OF SUB-STRUTS



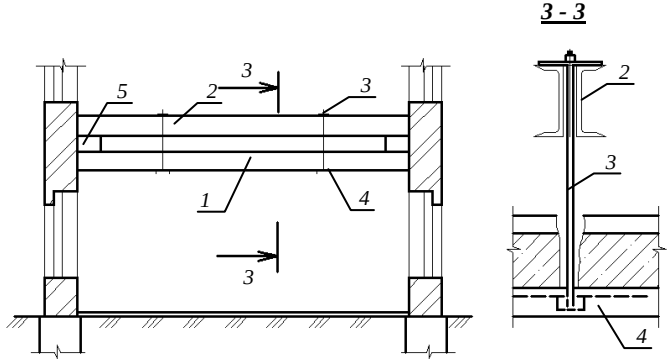
1 - reinforced concrete floor slabs to be strengthened; *2* - relieving square-sawn timber sub-struts; *3* - square-sawn timber pads; *4* - square-sawn timber pads; *5* - square-sawn timber struts (for simultaneous engaging sub-struts into work); *6* - ledgers; *7* - the floor of the building

POSITIONING OF RELIEVING BEAMS



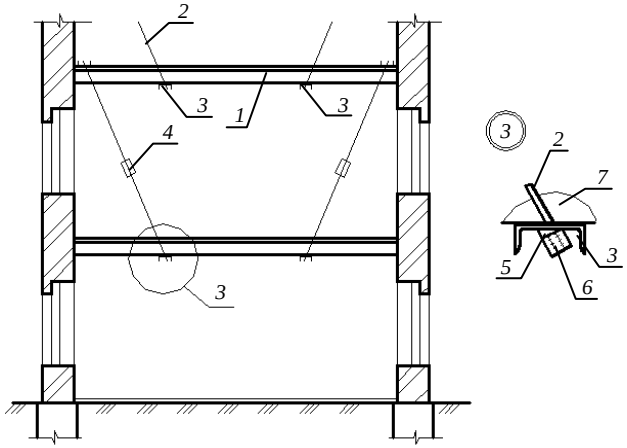
1- reinforced concrete floor slabs to be strengthened; *2* - metal or wooden relieving beams; *3* - wooden or metal posts; *4* - square-sawn timber ground beams; *5* - square-sawn timber pads; *6* - wedges for engaging relieving beams into work; *7*- the floor of the building; *8* - ledgers

SUSPENSION OF FLOOR SLABS TO RELIEVING BEAMS



1- reinforced concrete floor slabs to be strengthened; *2* - channel or double-tee metal relieving beams; *3* - suspenders in the form of metal tension bars passed through joints between slabs; *4* - channel pads; *5* - square-sawn timber ground beams

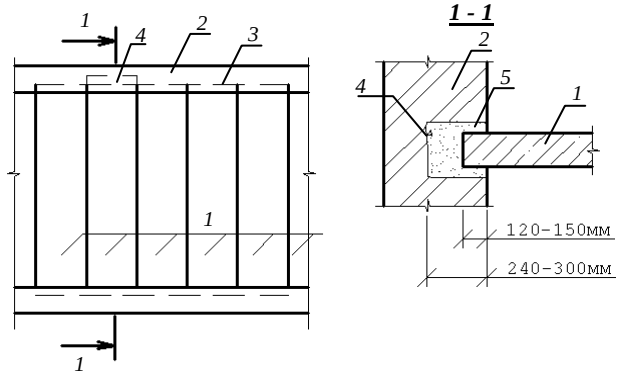
SETTING OF SUSPENDERS



1 - reinforced concrete floor slabs to be strengthened; *2* - reinforcing steel suspenders passed through joints between slabs; *3* - channel pads; *4* - couplings for tensioning the suspenders; *5* - diagonal washer; *6* - anchorage of suspenders

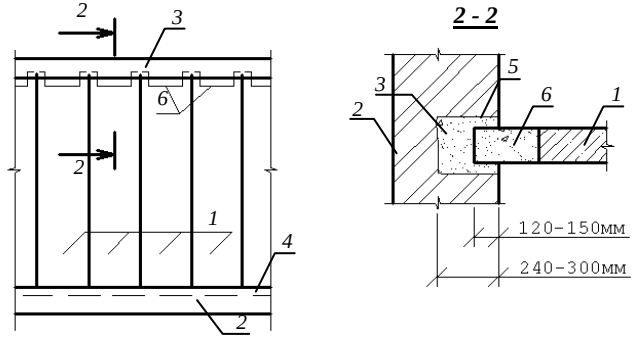
ARRANGEMENT OF FLOORS FROM LARGE-SIZED REINFORCED CONCRETE MEMBERS IN RECONSTRUCTING BUILDINGS AND STRUCTURES

FLOORS FROM SLABS BROUGHT INTO WALL JOGGLES



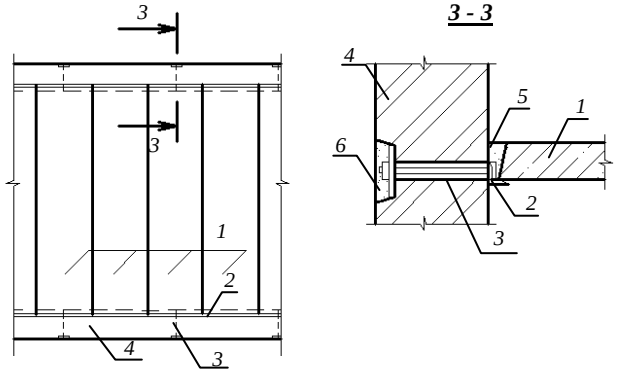
1 - reinforced concrete floor slabs brought into wall joggles in inclined position; *2* - brick walls; *3* -wall joggles from 120 to 150mm deep; *4* -240 to 300 ram deep joggle for placing floor slabs and their handling through joggles; *5* - concrete for grouting the joggles after floor slabs erection

FLOORS PROM SLABS WITH PROTRUDING RIBS BROUGHT INTO WALL RECESSES AND JOGGLES



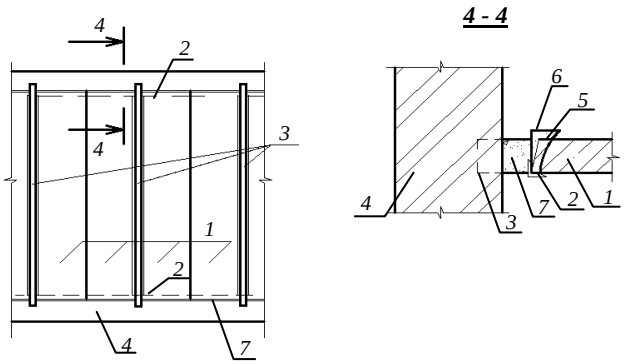
1- reinforced concrete floor slabs with protruding ribs put in recesses at inclined position of slabs; the other end of the slab is brought into joggles; *2* - brick walls; *3* - wall recess from 240 to 300 mm deep; *4* - wall joggle from 120 to 150 mm deep; *5* - concrete for joggle grouting; *6* - concrete for grouting the clearance between the wall, protruding ribs and slab butts

FLOORS FROM SLABS RESTING ON WALL ANGLES



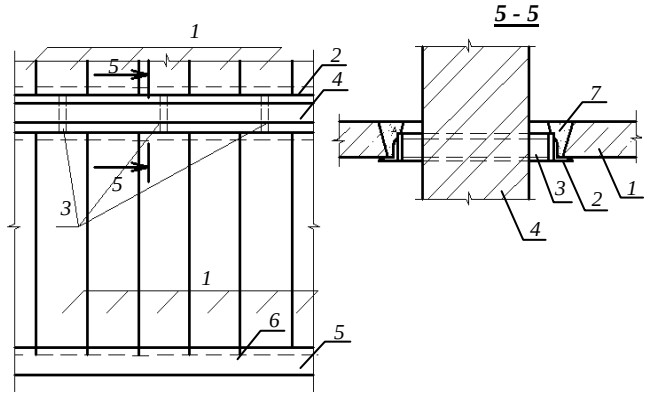
1 - reinforced concrete floor slabs resting on wall angles; *2* - wall angles attached to walls by means of tension bars at a distance from 1.5 to 2 m; *3* - tension bars with support washers; *4* - brick walls; *5* - grouting concrete; *6* - plaster

FLOORS FROM SLABS RESTING ON WALL BEAMS AND PURLINS



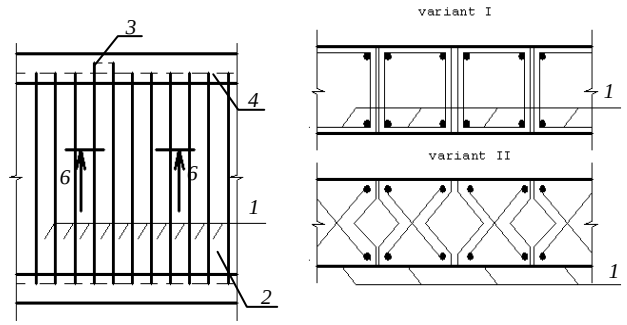
1 - reinforced concrete floor slabs resting on wall beams; *2* - angle wall beams welded to purlins; *3* - purlins (double tees) with support in recesses cut out in brick walls; *4* - brick walls; *5* - steel gussets set in joints between slabs and welded to wall beams; *6* - 25 mm diameter pivots closely wedged to slab top (for decreasing torsional moment in wall beams); *7* - grouting concrete

FLOORS FROM SLABS RESTING ON WALL BEAMS AND TWO-SIDED CANTILEVERS



1 - reinforced concrete floor slabs resting on angle wall beams; *2*-wall beams welded to double-tee two-sided cantilevers; *3* - double-cantilever beams placed in aperture in the middle wall (under beams there placed distribution pads); *4* - middle brick wall; *5* - external brick wall; *6* - joggle in external brick wall; *7* - grouting concrete

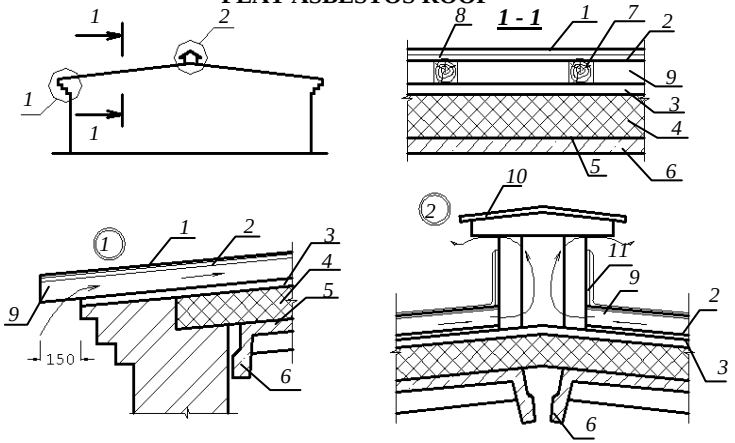
FLOORS FROM BEAM ELEMENTS BROUGHT INTO WALL JOGGLES



1 - reinforced concrete beam elements of floor (continuous, square or x-section; up to 9 m long; made in pile shutters) brought into wall joggles in inclined position; *2* - wall joggles from 120 to 150 mm deep; *3* - joggle from 240 to 300 mm deep for placing floor elements (to be grouted after erecting the floor elements)

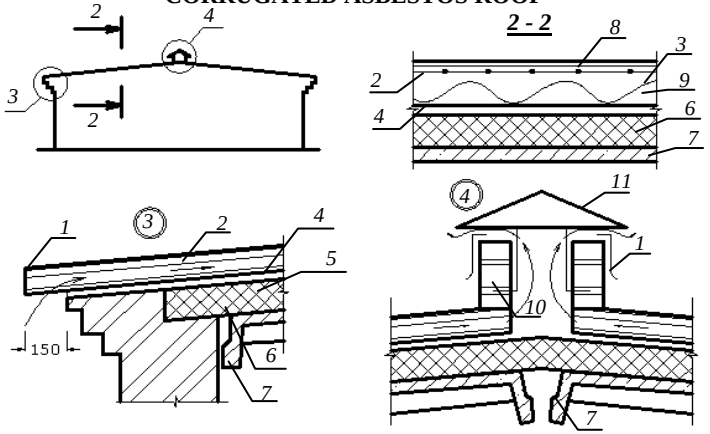
RECONSTRUCTION OF NON-VENTILATED ROOFS INTO VENTILATED ONES

FLAT ASBESTOS ROOF



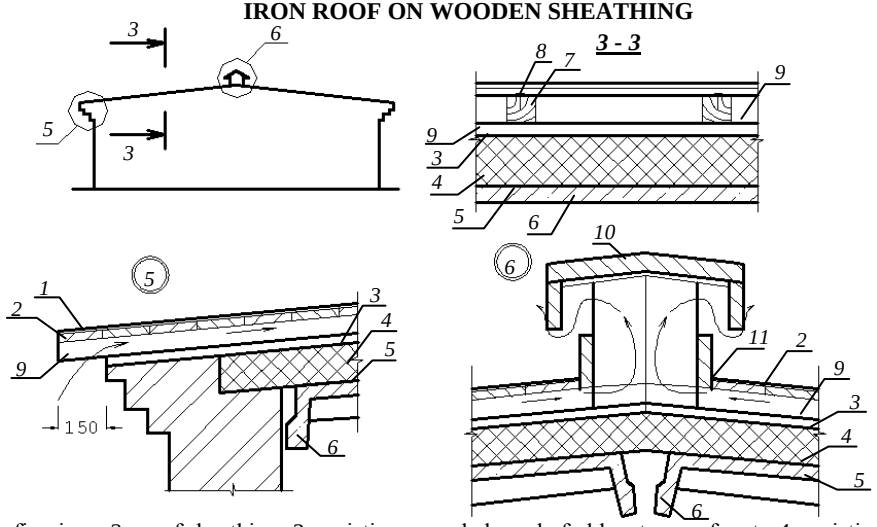
1 - waterproof mat; *2* - flat asbestos; *3* - existing screed cleared of old waterproof mat; *4* - existing warmth- keeping logging; *5* - vapour seal; *6* - reinforced concrete slab; *7* - 50x50 mm wooden bars spaced at 0.5m; *8* - wood screws; *9* - air ducts; *10* - asbestos canopy with waterproof mat glued on; *11* - asbestos duct walls

CORRUGATED ASBESTOS ROOF



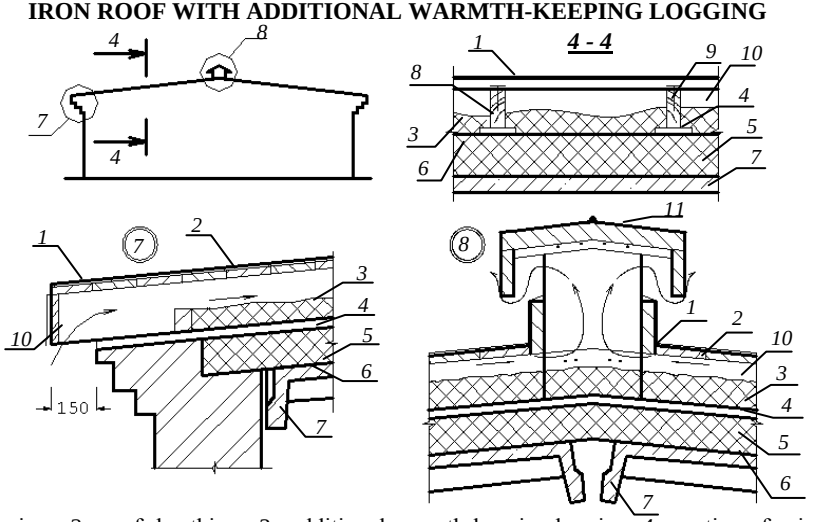
1 - waterproof mat; *2* - asphalt or cement-sand screed; *3* - corrugated asbestos; *4* - existing screed cleared of old waterproof mat; *5* - existing warmth-keeping logging; *6* - vapour seal;*7* - reinforced concrete slab; *8* - mesh; *9* - air duct; *10* - duct mesh half a brick thick; *11* - roofing iron canopy; *12* - roofing iron apron

IRON ROOF ON WOODEN SHEATHING



1 - roofing iron; *2* - roof sheathing; *3* - existing screed cleared of old waterproof mat; *4* - existing warmth-keeping logging; *5* - vapour seal; *6* - reinforced concrete slab; *7* - 50x50 mm wooden bars spaced at 1.0 m; *8* - nails; *9* - air duct; *10* - canopy made of roofing iron covered boards; *11* - duct board walls

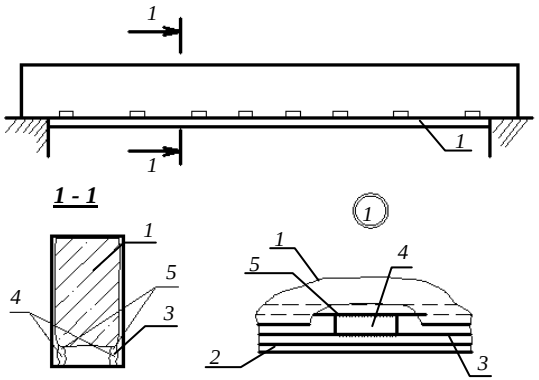
IRON ROOF WITH ADDITIONAL WARMTH-KEEPING LOGGING



1 - roofing iron; *2* - roof sheathing; *3* - additional warmth-keeping logging; *4* - portion of existing screed used as supports for roof boards; *5* - existing warmth-keeping logging; *6* - vapour seal; *7* - rein-forced concrete slab; *8* - 50x200 mm roof boards spaced at 1.0 m; *9* - nails; *10* - air duct; *11* - canopy made of boards covered with roofing iron; *12* - duct board walls

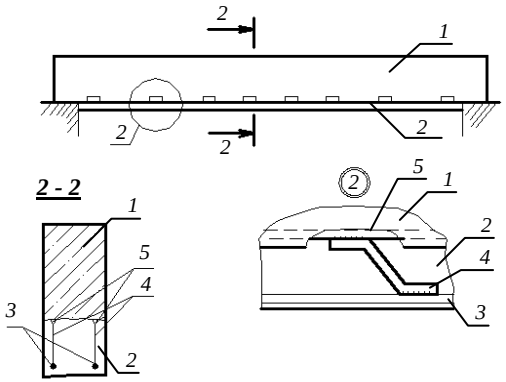
STRENGTHENING OF REINFORCED CONCRETE BEAMS

SPLICING OF BEAMS FROM BELOW FOR THE PURPOSE OF SLIGHT INCREASE IN THEIR BEARIHG CAPACITY



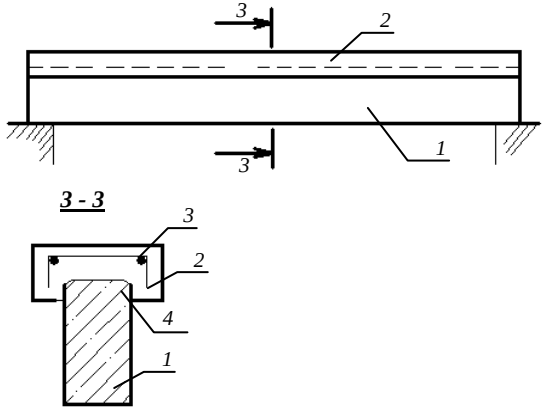
1 - beam under strengthening; *2* - reinforced concrete splice; *3* - strengthening longitudinal reinforcement; *4* - short reinforcing rods; *5* - exposed reinforcement of beam (sections spaced at 1.0 m)

SPLICING OF BEAMS FROM BELOW FOR THE PURPOSE OF CONSIDERABLE INCREASE IN THEIR BEARING CAPACITY



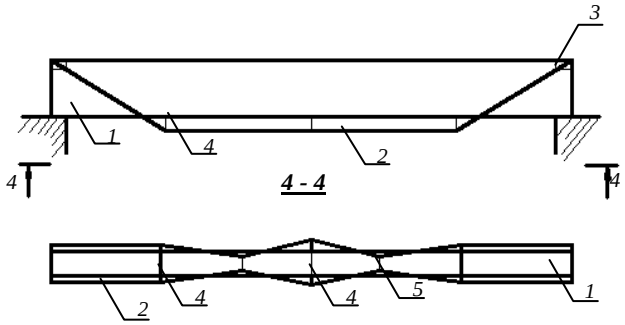
1 - beam under strengthening; *2* - reinforced concrete splices; *3* -strengthening longitudinal reinforcement; *4* - bent reinforcement bars; *5* - exposed reinforcement of beam (sections spaced at 1.0m)

SPLICING OF BEAMS FROM ABOVE



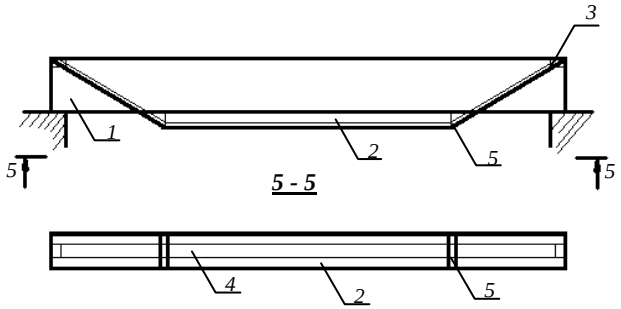
1 - beam under strengthening; *2* - strengthening reinforced concrete jacket; *3* - strengthening reinforcement; *4* - bond surface between cast-in-place concrete and beam (cleandowned and hacked)

SETTING OF REINFORCING STEEL STRUT-FRAMES



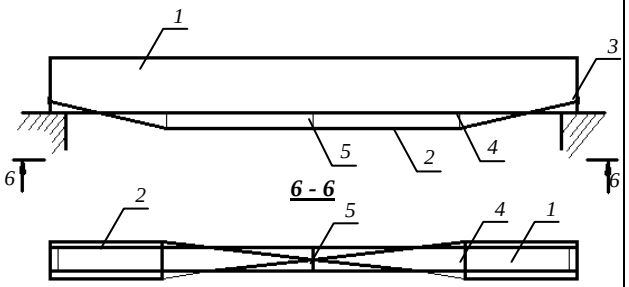
1 - beam under strengthening; *2* - prestressed reinforcing steel strut-frame; *3* - supporting device; *4* - struts; *5* - band

SETTING OF ROLLED METAL STRUT-FRAMES



1 - beam under strengthening; *2* - prestressed rolled metal strutframe; *3* - supporting device; *4* - struts; *5* - stressing screws

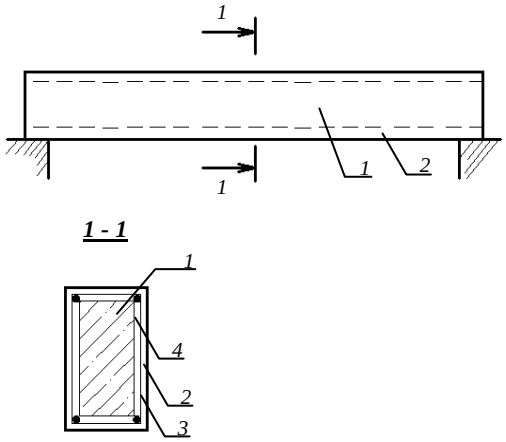
SETTING OF STRUTTED TIES



1 - beam under strengthening; *2* - prestressed reinforcing or rolled steel strut-frame; *3* - supporting device; *4* - struts; *5* - band

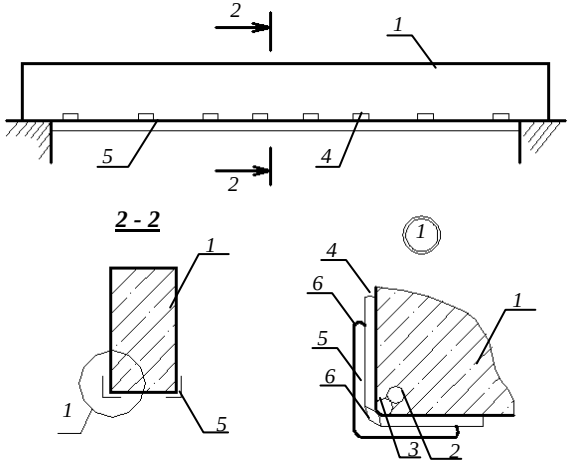
STRENGTHENING OF REINFORCED CONCRETE BEAMS

REINFORCED CONCRETE YOKE ARRANGEMENT



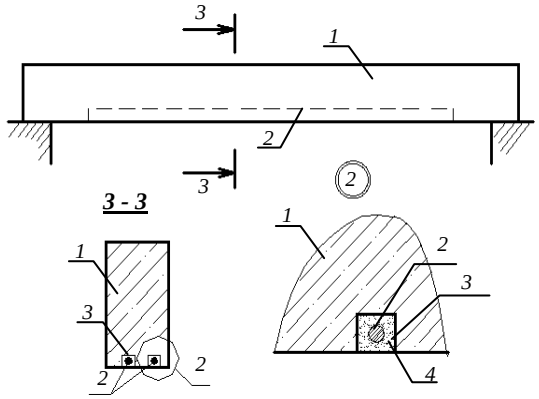
1 - beam under strengthening; *2* - strengthening reinforced concrete yoke; *3* - strengthening reinforcement; *4* - bond surface between cast-in-place concrete and beam

SETTING OF METAL ANGLES



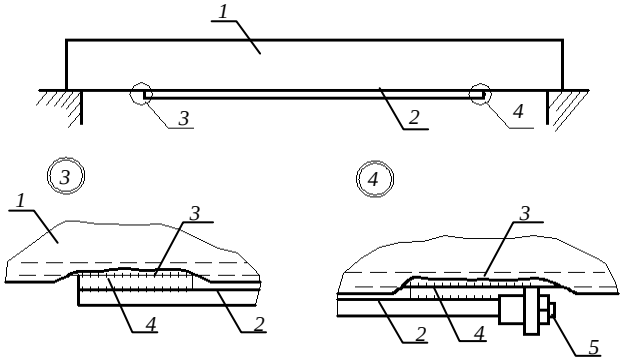
1 - beam under strengthening; *2* - existing reinforcement of beam; *3* - short reinforcing rods; *4* - metal plates; *5* - rolled angle; *6*- welding

SETTING OF ADDITIONAL REINFORCEMENT BY USING POLYMER MORTAR



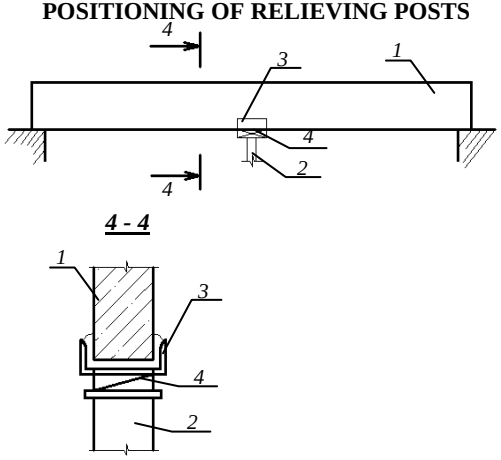
1 - beam under strengthening; *2* - additional reinforcement; *3* - grooves milled in concrete; *4* - protective structural polymer-mortar

SETTING OF REINFORCING STEEL TIES



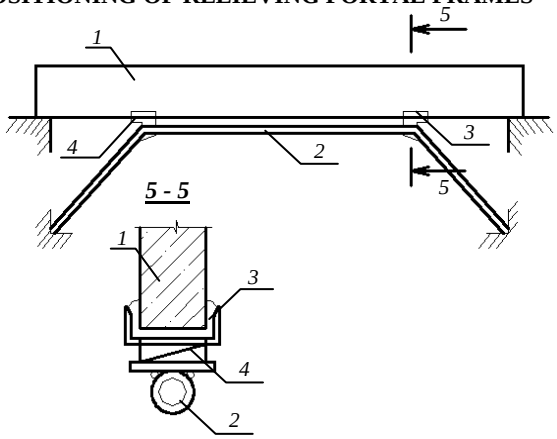
1 - beam under strengthening; *2* - prestreesed reinforcing steel ties; *3* - exposed (ordinary) beam reinforcement; *4* - short reinforcing rods; *5* - stressing device

POSITIONING OF RELIEVING POSTS



1 - beam under strengthening; *2* - additional support-post; *3* -channel bearing elements; *4* - metal wedges for engaging the post into work

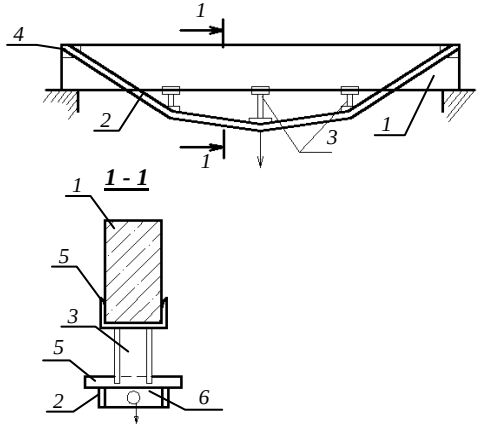
POSITIONING OF RELIEVING PORTAL FRAMES



1 - beam under strengthening; *2* - additional support-portal frame; *3* - channel bearing elements; *4* - metal wedges for engaging the portal frame into work

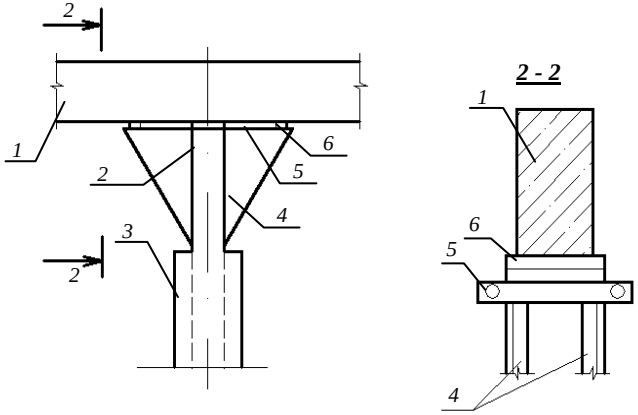
STRENGTHENING OF REINFORCED CONCRETE BEAMS

SETTING OF HINGE-ROD CHAINS



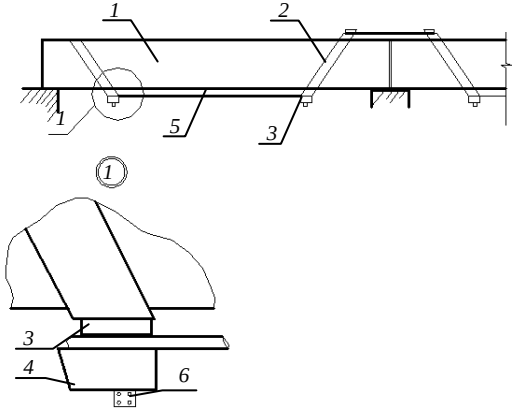
1 - beam under strengthening; *2* - hinge-rod chain of two angles or rods; *3* - channel or double-tee posts; *4* - supporting device; *5* - supporting channel elements; *6* - plate with holes for suspension of tension load

POSITIONING OF RELIEVING SUB-STRUTS



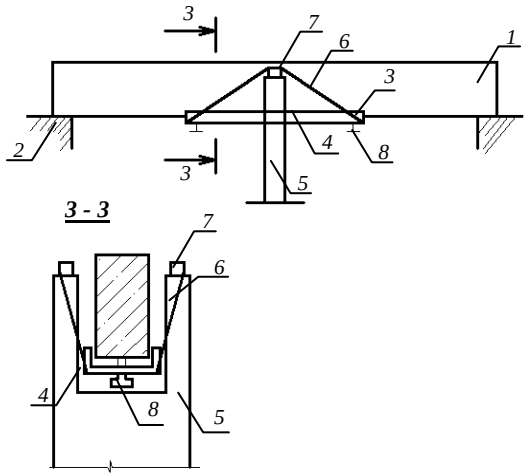
1 - beams under strengthening; *2* - column; *3* - yoke (metal or reinforced concrete); *4* - metal sub-struts; *5* - tie with tension coupling; *6* - metal pads on graphite lubrication

SETTING OF SLOPING STIRRUPS CONNECTED BY FLEXIBLE CLOSED REINFORCEMENT



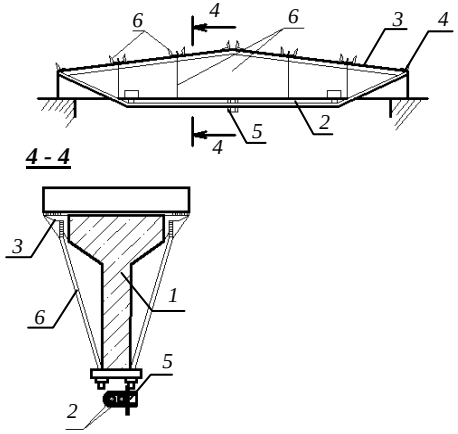
1 - beam under strengthening; *2* - sheet metal sloping stirrups; *3* - bevelled supports; *4* - caps; *5* - closed reinforcing element; *6* - bolt (bolt screwing creates controlled stress of closed reinforcing element)

POSITIONING OF PROPS WITH GUYS



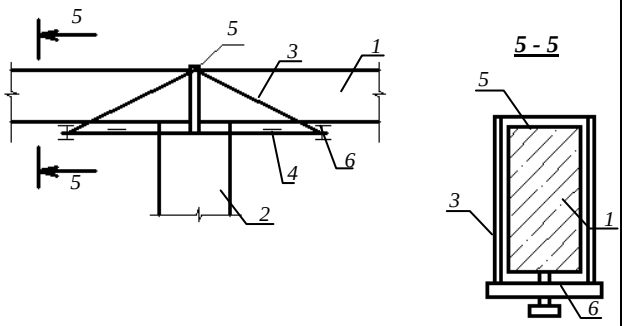
1 - beam under strengthening; *2* - supports; *3* - additional supports; *4* - strut; *5* - strengthening posts; *6* - guys; *7* - hingers; *8* - bolts

SETTING OF STRUTTED TIE WITH ADDITIONAL ELEMENT IN COMPRESSED ZONE



1 - beam under strengthening with defects in compressed zone; *2* - strutted tie to be stressed; *3* - additional compression element; *4* - tie fix-ing point; *5* - brace device of tie elements; *6* - additional compressed element ties to retain stability

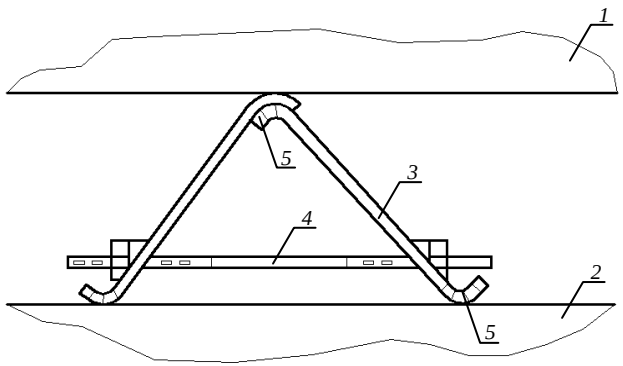
POSITIONING OF RELIEVING BRACKETS



1 - beams under strengthening; *2* - column; *3* - relieving bracket; *4* - cross ties along the lower chord; *5* - bracket support; *6* - supporting device with tension bolt

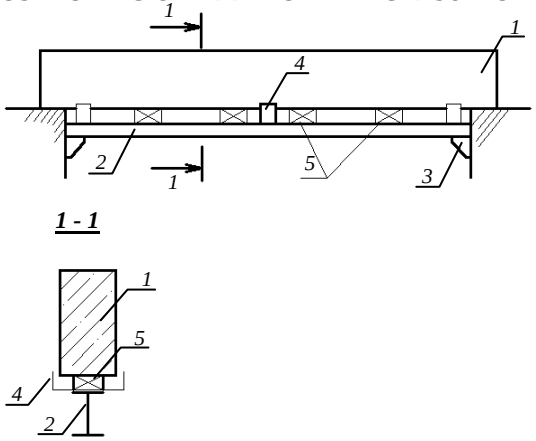
STRENGTHENING OF REINFORCED CONCRETE BEAMS

SETTING OF ADDITIONAL SUPPORTS WITH S-SHAPED PLATE STRUTS



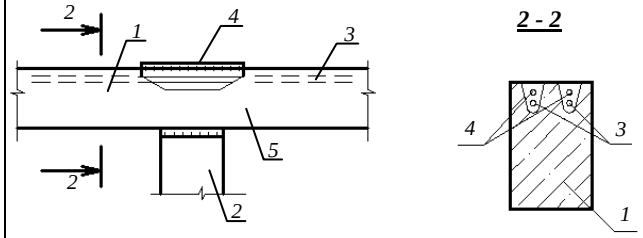
1 - structure (slab, beam) under strengthening; *2* - additional support; *3* - S-shaped plates; *4* - screw coupling; *5* - welding (should be done after additional supports begin to work)

POSITIONING OF ADDITIONAL RIGID SUPPORT



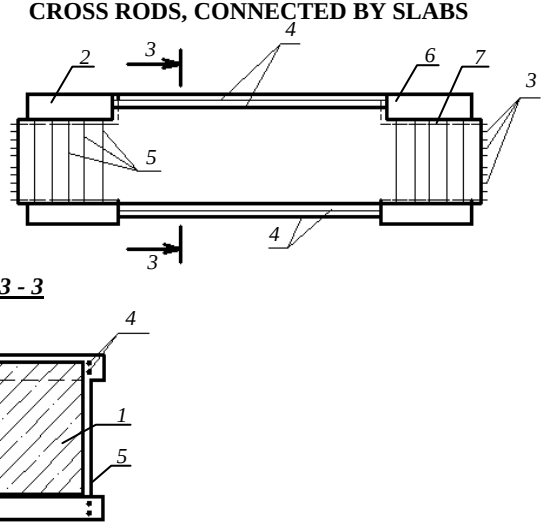
1 - beam under strengthening; *2* - strengthening metal beam; *3* - metal beam supports; *4* - fixing angles; *5* - pads (metal wedges) for engaging strengthening metal beam into work

FORMATION OF CONTINUOUS SYSTEM



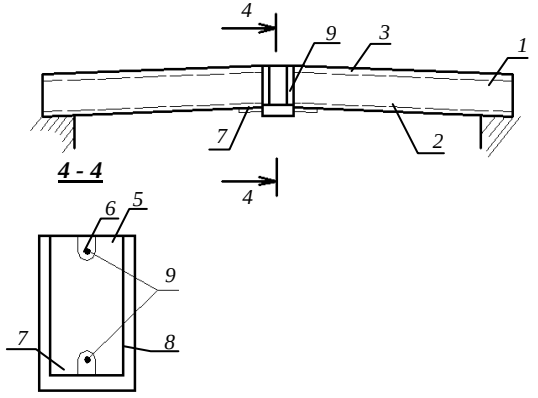
1 - beam under strengthening; *2* - column; *3* - exposed top reinforcement of beam; *4* - tie rod to be welded; *5* - interbeam joint to be wedged out by metal plates

SETTING OF ADDITIONAL LONGITUDINAL AND CROSS RODS, CONNECTED BY SLABS



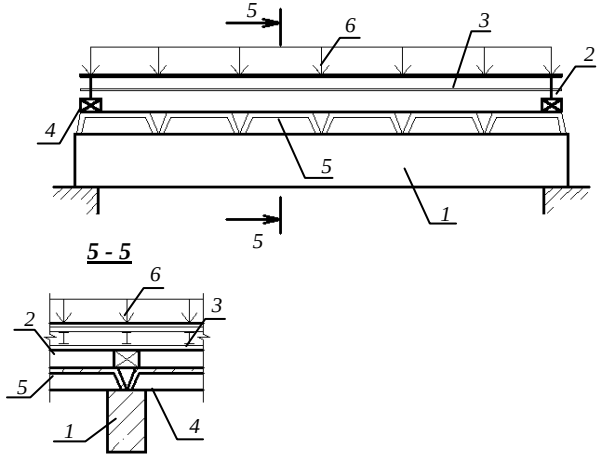
1 - beam under strengthening; *2* - ledges; *3* - protruding bars; *4* - additional longitudinal rods; *5* - additional transverse prestressed reinforcement; *6* - concrete-metal slabs; *7* - cast-in metal plates

FORMATION OF INVERTED BEND WITH ITS FIXATION BY WEDGE-SHAPED ELEMENT



1 - beam under strengthening; *2* - lower zone reinforcement; *3* - upper zone reinforcement; *4* - cross slot with a cut in top reinforcement; *5* - steel polymer concrete wedge with holes for reinforcement (wedge should be set in after beam bend formation); *6* - reinforcing rod weld-ed to the cut upper reinforcement; *7* - shaped steel strip glued on con-crete; *8* - II-shaped frame-formwork; *9* - filling all empty cavities with liquid polymer concrete

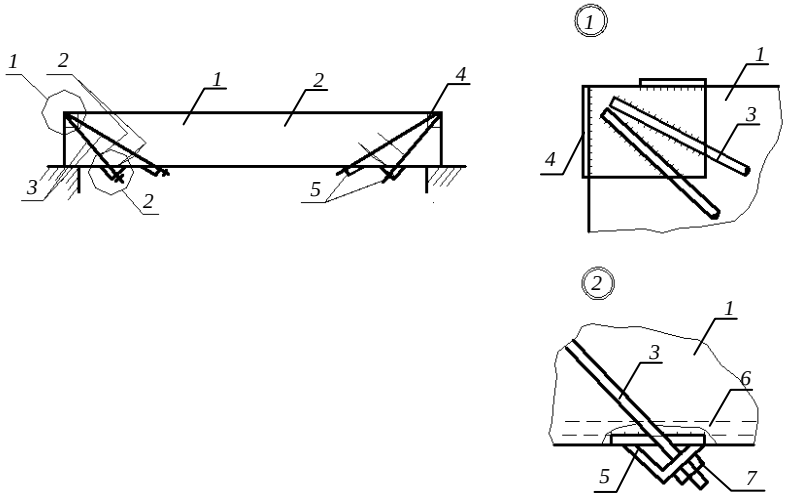
TRANSFERING A PART OF THE LOAD TO RELIEVING BEAMS



1 - beam under strengthening; *2* - main double-tee relieving beams; *3* - secondary double-tee relieving beams; *4* - pads for making clearance between relieving and strengthened elements; *5* - floor slabs; *6* - load relieved from strengthened beam

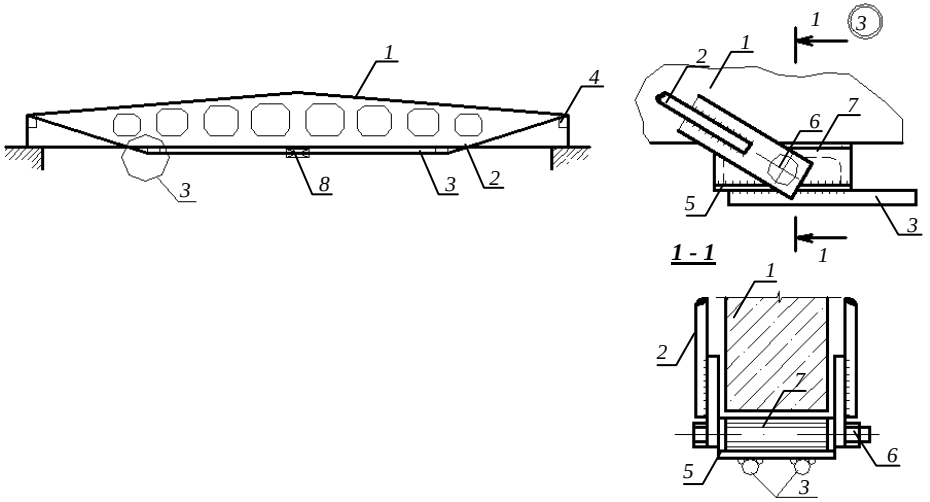
STRENGTHENING OF REINFORCED CONCRETE BEAMS

SETTING OF PRESTRESSED INCLINED TIES



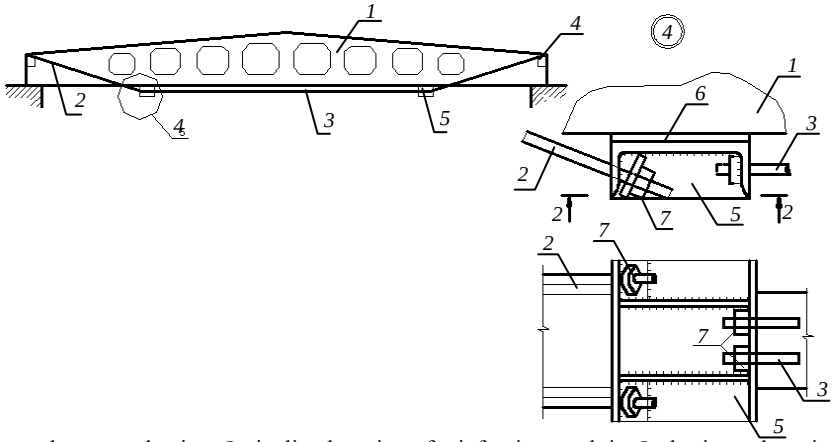
1 - beam under strengthening; *2* - diagonal cracks in beam; *3* - inclined reinforcing steal ties; *4* - metal plate upper support base placed on beam by means of mortar; *5* - lower support base formed of plates and angle welded to exposed reinforcement of beam; *6* - exposed principle reinforcement of beam; *7* - nut for tensioning the ties

SETTING OF PRESTRESSED STRUTTED TIES OF LINEAR ELEMENTS



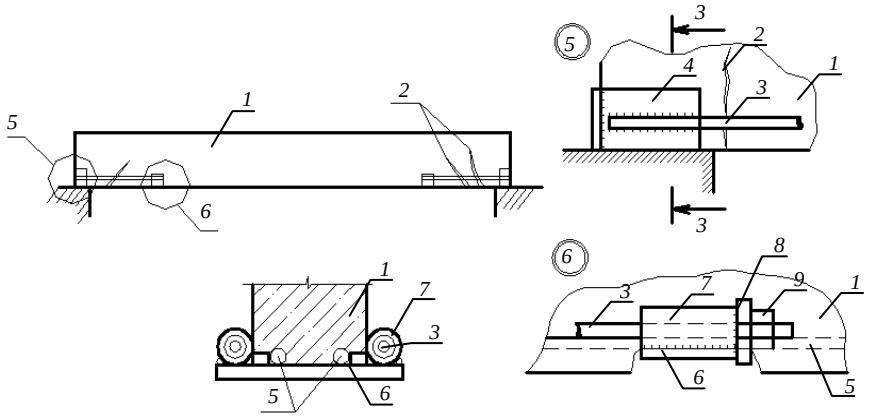
1 - beam under strengthening; *2* - inclined section of reinforcing steel tie; *3* - horizontal section of reinforcing steel tie; *4* - upper support base formed of plates; *5* - lower support base formed of channel; *6* - hinged (bolt) fastening of tie inclined section to lower support base; *7* - leveling course of mortar; *8* - couplings for tensioning the ties

SETTING OF PRESTRESSED STRUTTED TIES OF LINEAR ELEMENTS



1 - beam under strengthening; *2* - inclined section of reinforcing steel tie; *3* - horizontal section of reinforcing steel tie; *4* - upper support base formed of plates; *5* - lower support base formed of channel; *6* - leveling course of cement-sand mortar; *7* - nut for tensioning the ties

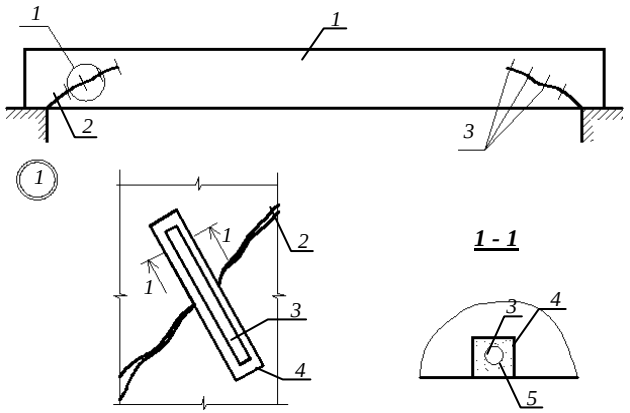
SETTING OF PRESTRESSED SUPPORT TIES



1 - beam under strengthening; *2* - cracks in support zone of beam; *3* - reinforcing steel support ties; *4* - support base of metal plate ties; *5* - exposed principle reinforcement of beam; *6* - plate welded to exposed reinforcement of beam; *7* - sockets welded to plate; *8* - washers; *9* - nuts for tensioning the ties

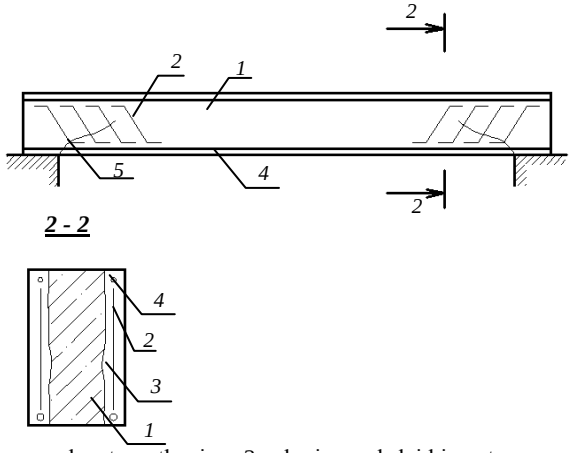
STRENGTHENING OF SUPPORTING SECTIONS OF BEAMS

SETTING OF REINFORCING RODS BY GLUEING



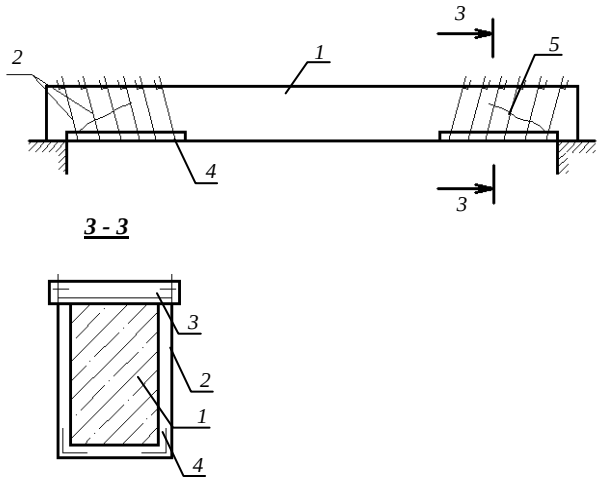
1 - beam under strengthening; *2* - cracks in beam; *3* - 6-8 mm diameter reinforcing rods; *4* - milled grooves in concrete; *5* - protectti-ve-structural polymer mortar

WELDING OF ADDITIONAL SLOPING RODS



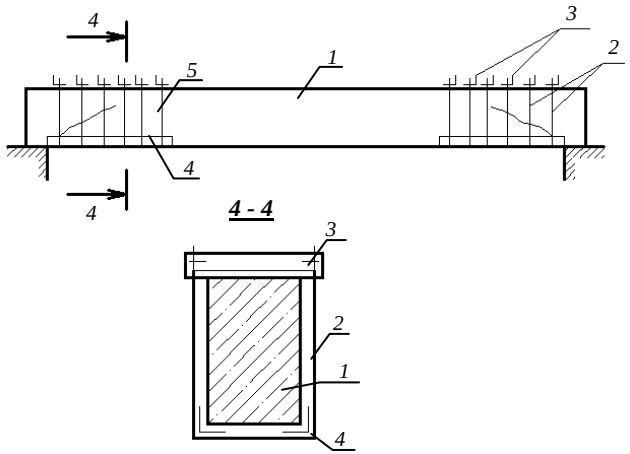
1 - beam under strengthening; *2* - sloping rods laid in cut grooves and welded to longitudinal reinforcement of beams; *3* - cement-sand 10MPa mortar; *4* - longitudinal reinforcement of beams; *5* - cracks in beam

SETTING OF SLOPING STIRRUPS



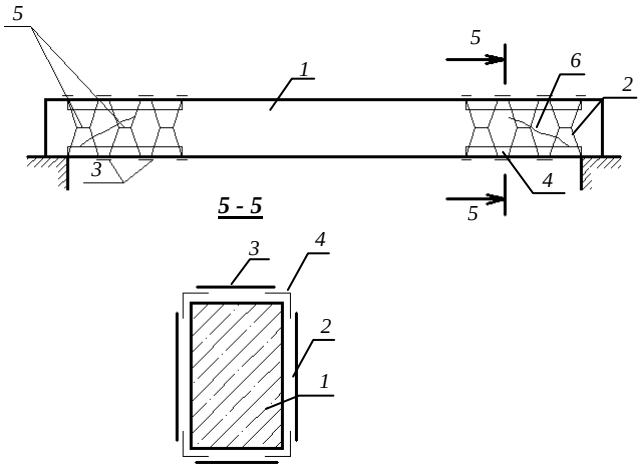
1 - beam under strengthening; *2* - sloping stirrups with nuts; *3* - cross angles; *4* - longitudinal angles; *5* - cracks in beam

SETTING OF CROSS STIRRUPS



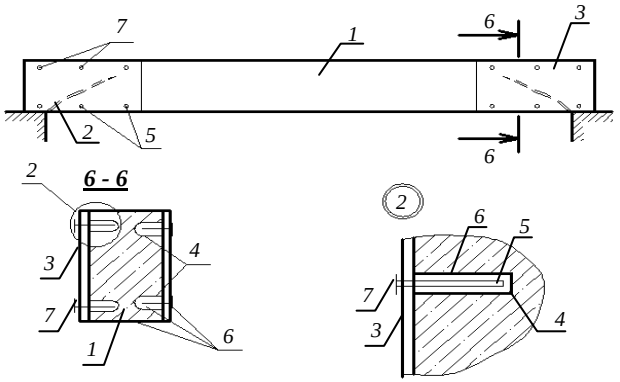
1 - beam under strengthening; *2* - stirrups with nuts; *3* - cross angles; *4* - longitudinal angles; *5* - cracks in beam

SETTING OF BANDS



1 - beam under strengthening; *2* - cross rods; *3* - scabs; *4* - longitudinal angles; *5* - bands; *6* - cracks in beam

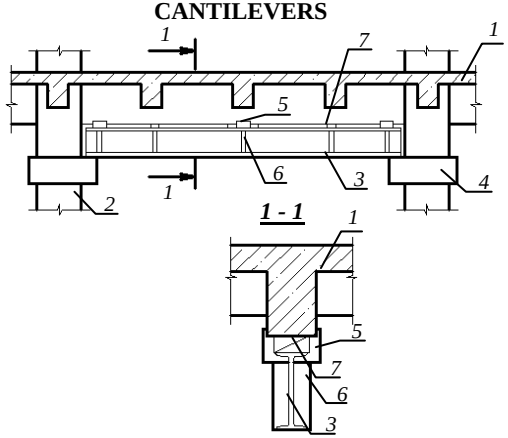
GLUEING OF SHEET METAL



1 - beam under strengthening; *2* - cracks in beam; *3* - metal sheets 1-2 mm thick; *4* - drilled pockets in concrete; *5* - 6-10 mm diameter, 80-120 mm long reinforcing anchors; *6* - protective-structural polymer mortar; *7* - welding

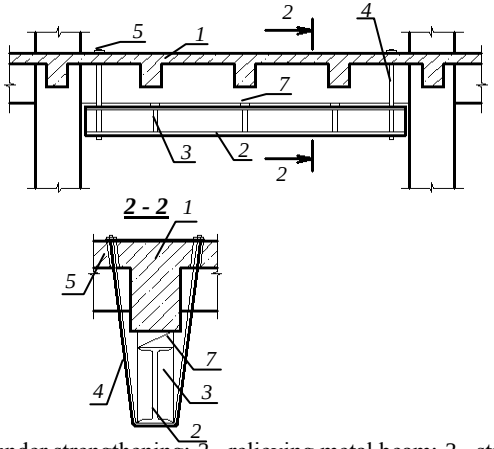
STRENGTHENING OF CAST-IN-PLACE REINFORCED CONCRETE FLOOR BEAMS

POSITIONING OF RELIEVING BEAMS BY MEANS OF CANTILEVERS



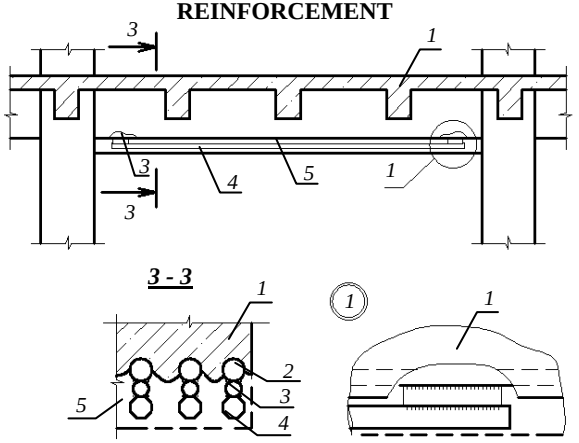
1 - beam under strengthening; 2 - columns; 3 - relieving metal beam; 4 - bearing cantilevers on columns in the form of reinforced con-crete or metal yoke; 5 - fixing angles of relieving beam final posi-tion; 6 - stiffening ribs; 7 - plate-wedges for engaging relieving beams into the joint work

POSITIONING OF RELIEVING BEAMS BY MEANS OF STIRRUPS



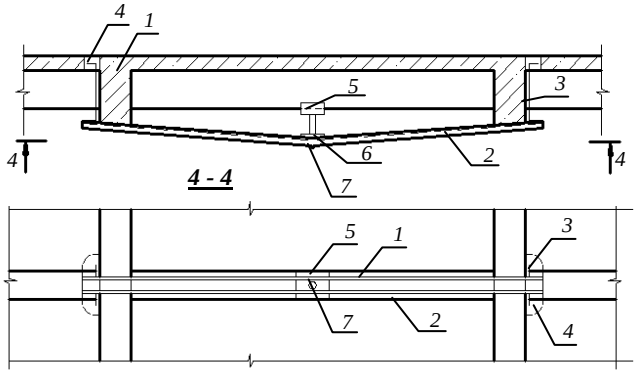
1 - beam under strengthening; *2* - relieving metal beam; *3* - stiffening ribs; *4* - stirrups for relieving beam fixing; *5* - plate-jig of stirrups; *6* - holes in slab for stirrups; *7* - plate-wedges for engaging relieving beams into joint work

SETTING OF ADDITIONAL THERMOSTRESSED REINFORCEMENT



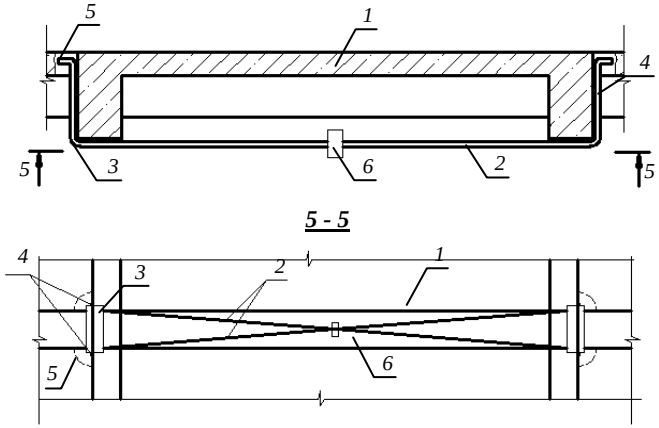
1 - beam under strengthening; *2* - exposed principle reinforce-ment of beam; *3* - reinforcing short-rods welded to exposed rein-forcement; *4* - additional thermostressed reinforcement (to be welded to short-rods in heated stats); *5* - gunite or dense cement sand plaster

SETTING OF CHANNEL TIES



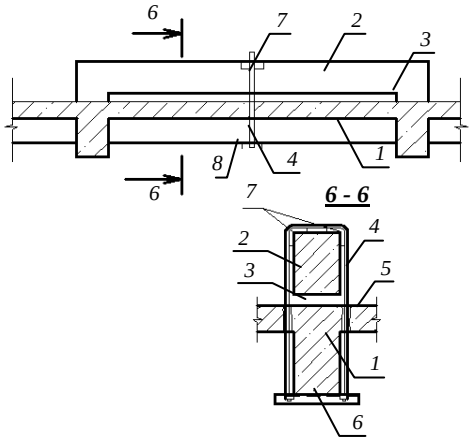
1 - beam under strengthening; *2* - channel tie; *3* - anchor devices; *4* - holes in slab concreted after anchors placing; *5* - channel pad; *6* - nut welded to tie; *7* - coupling bolt

SETTING OF REINFORCING STEEL HORIZONTAL TIES



1 - beam under strengthening; *2* - reinforcing steel horizontal ties; *3* - angle tie anchor; *4* - vertical jigs of reinforcing steel angle-anchors, embeded in notched holes in slab; *5* - holes in slab concreted after jigs setting; *6* - band

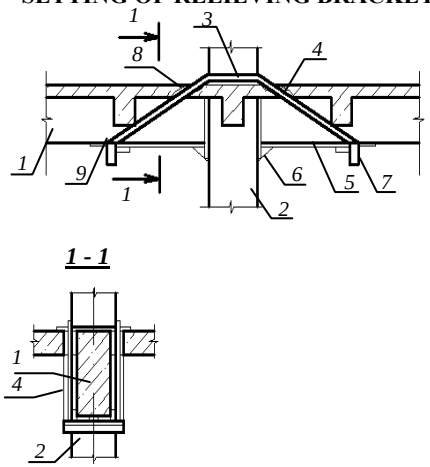
SUSPENDERS TO RELIEVING BEAMS



1 - beam under strengthening; *2* - relieving beam (reinforced con-crete or metal); *3* - clearance between relievingbeam and the floor; *4* - tension stirrup; *5* - holes in slab for stirrup; *6* - channel bearing elements; *7* - angle pads

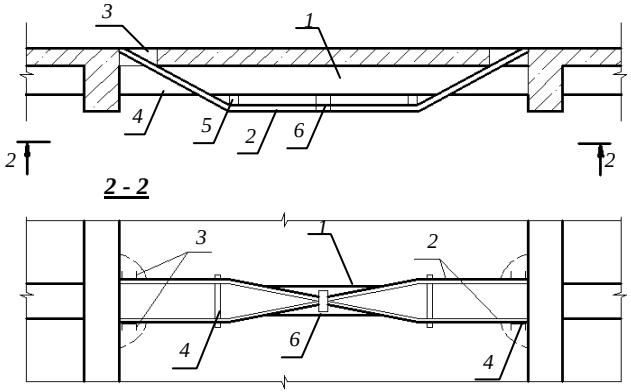
STRENGTHENING OF CAST-IN-PLACE REINFORCED CONCRETE FLOOR BEAMS

SETTING OF RELIEVING BRACKETS



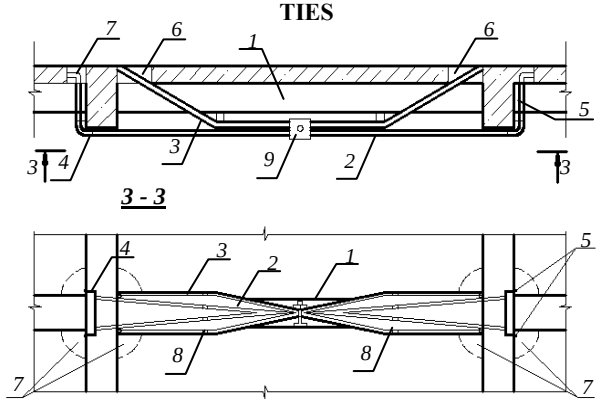
1 - beam under strengthening; *2* - column; *3* - relieving brackets; *4* - bracket tension bars; *5* - bracket horizontal elements; *6* - bracket stops; *7* - angle-stops; *8* - holes in slab for tension bars; *9* - wedges for engaging brackets into the join work

SETTING OF REINFORCING STEEL STRUTTED TIES



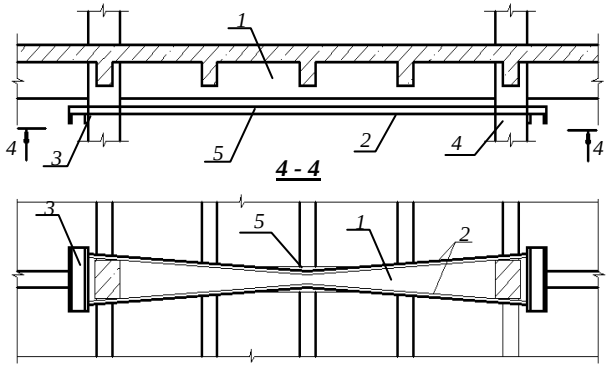
1 - beam under strengthening; *2* - reinforcing steel strutted tie; *3* -supporting anchors of strutted tie embeded in notched holes in slab; *4* - holes in slab concreted after anchors setting; *5* - pads in the form of roller welded to plate; *6* - band

SETTING OF REINFORCING STEEL COMPOSITE TIES



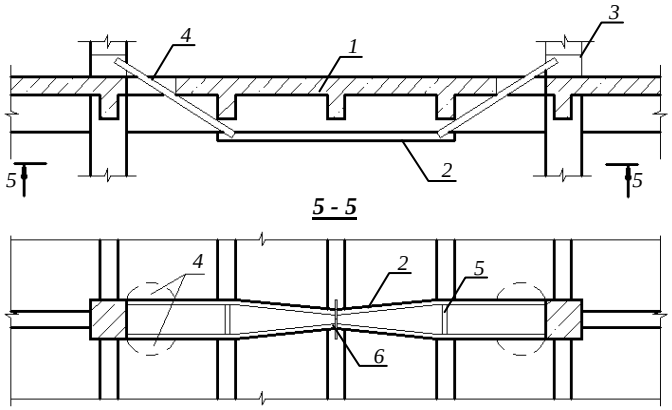
1 - beam under strengthening; *2* - reinforcing steel horizontal tie; *3* - reinforcing steel strutted tie; *4* - horizontal tie anchors; *5* -anchor jigs embeded in slab; *6* - strutted tie anchors embeded in slab; *7* - holes in slab concreted after anchors and jigs setting; *8* - pad-short rods; *9* - coupling bolt

SETTING OF ANGLE HORIZONTAL TIES



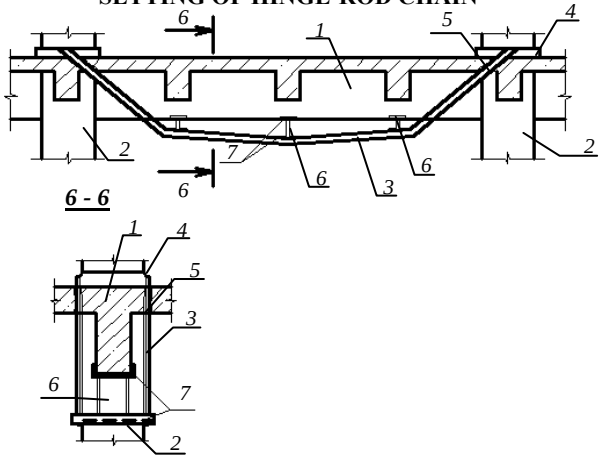
1 - beam under strengthening; *2* - angle horizontal tie welded to anchors; *3* - channel anchor set in groove cut in column and welded to column exposed reinforcement; *4* - reinforced concrete column; *5* - coupling bolt

SETTING OP ROLLED ANCLE STRUTTED TIES



1 - beam under strengthening; *2* - rolled angle strutted tie; *3* –supporting anchors of strutted ties setting; *4* - bearing pad; *5* - coupling bolt

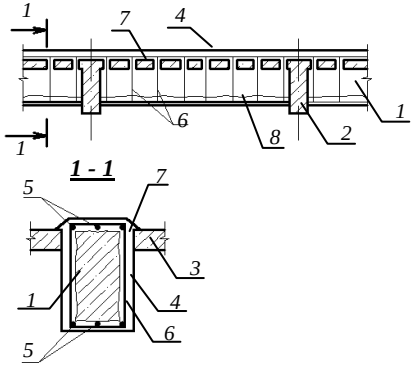
SETTING OF HINGE-ROD CHAIN



1 - beam under strengthening; *2* - column; *3* - reinforcing steel hinge-rod chain; *4* - chain anchor devices in the form of metal rings on columns; *5* - holes in slab for chains; *6* - channel posts; *7* - channel bearing elements

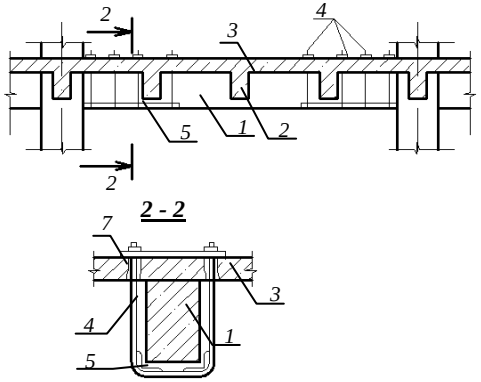
STRENGTHENING OF CAST-IN-PLACE REINFORCED CONCRETE FLOOR BEAMS

ARRENGEMENT OF REINFORCED CONCRETE YOKE



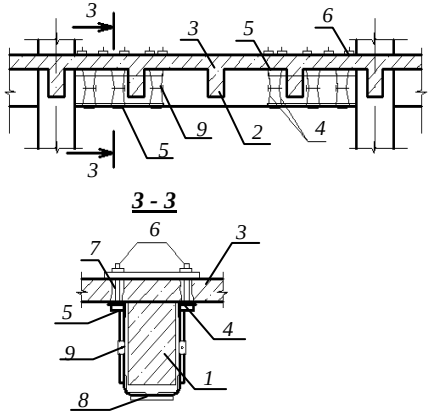
1 - secondary beams under strengthening; *2* - main beams; *3* - slab; *4* - reinforced concrete yoke; *5* - longitudinal reinforcement of yoke; *6* - yoke stirrups;*7* - holes in slab for stirrups and concrete; *8* - beam surface prepared for concreting (cleandowned and hacked)

SETTING OF BANDS AT SUPPORT



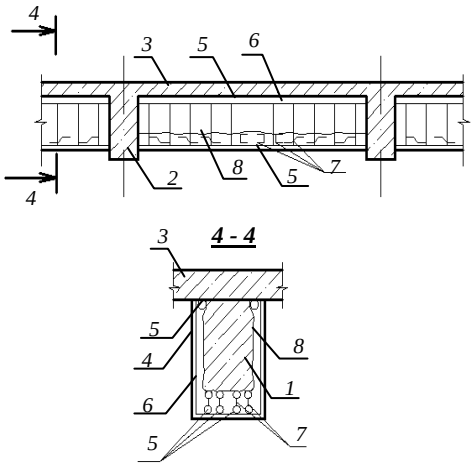
1 - main beam under strengthening; *2* - secondary beam; *3* - slab; *4* - metal bands with nuts; *5* - angle pad; *6* - pad-washer; *7* - holes drilled in slab for stirrups

SETTING OF BRACED CROSS RODS AT SUPPORTS



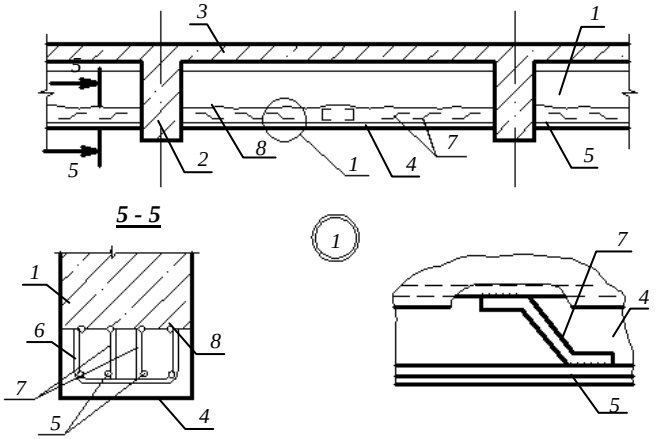
1 - main beam under strengthening; *2* - secondary beams; *3* - slab; *4* - cross rods welded to angles; *5* - angles; *6* - fastening bolts; *7* - holes drilled in slab bolts; *8* - scabs; *9* - coupling bolts

ARRENGEMENT OF REINFORCED CONCRETE JACKET



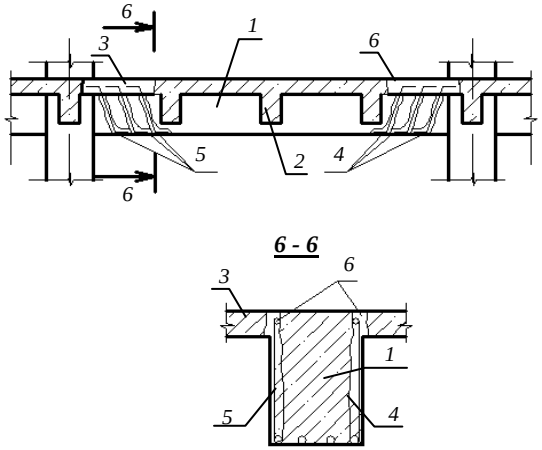
1 - secondary beams under strengthening; *2* - main beams; *3* - slab; *4* - reinforced concrete jacket; *5* - longitudinal reinforcement of jack-et; *6* - jacket stirrups; *7* - bent reinforcing short rods welded to beam exposed reinforcement and jacket reinforcement; *8* - treated surface of beams

ARRANGEMENT OF REINFORCED CONCRETE SPLICE



1 - secondary beams under strengthening; *2* - main beams; *3* - slab; *4* - reinforced concrete splice; *5* - longitudinal reinforcement of splice; *6* - stirrups; *7* - bent reinforcing short rods welded to exposed reinforcement of beam and reinforcement of splice; *8* - treated lower surface of beams

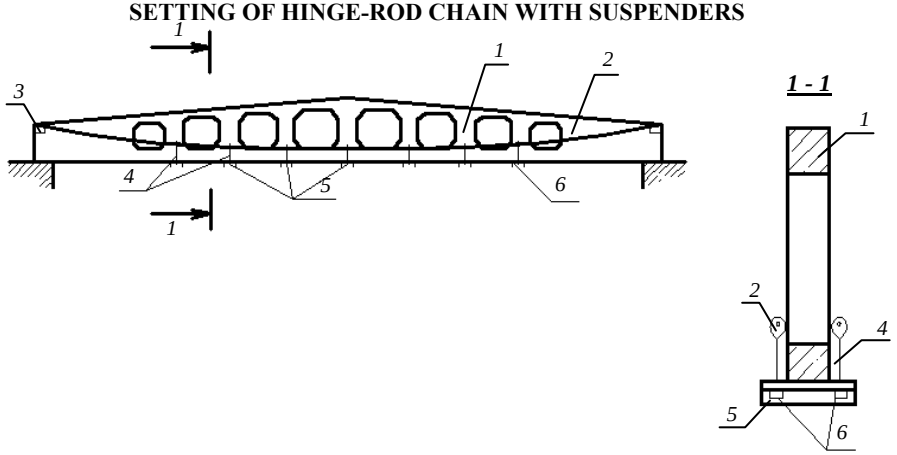
WELDING OF SLOPING RODS AT SUPPORTS



1 - beam under strengthening; *2* - secondary beams; *3* - slab; *4* - sloping reinforcing rods welded to exposed upper and lower principle reinforcement of beam under strengthening; *5* - grooves for setting additional reinforcing rods (to be filled with concrete after rods setting); *6* - holes out in slab for sloping rods (to be filled with concrete after rode setting)

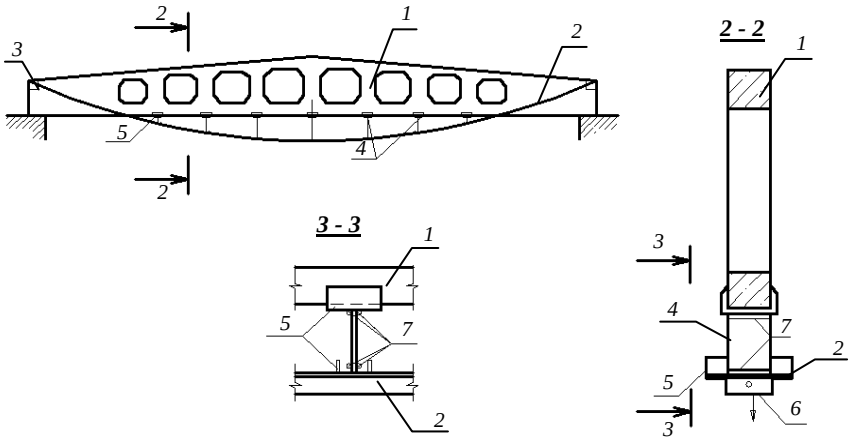
STRENGTHENING OF REINFORCED CONCRETE ROOF BEAMS

SETTING OF HINGE-ROD CHAIN WITH SUSPENDERS



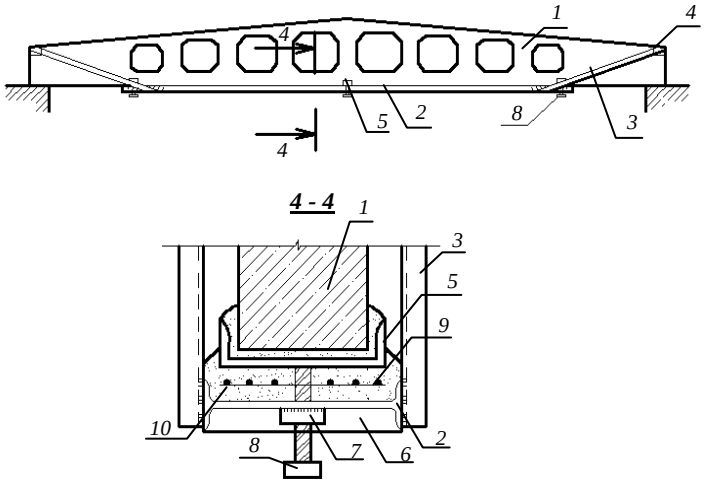
1 - beam under strengthening; *2* - hinge rod chain (reinforcing rods, tendons); *3* - bearing unit of hinge rod chain;*4* - reinforcing steel suspenders with hinge fastening from one side and thread from the other; *5* - supporting elements in the form of channel beams; *6* - tension nut

SETTING OF HINGE-ROD CHAIN WITH STRUTS



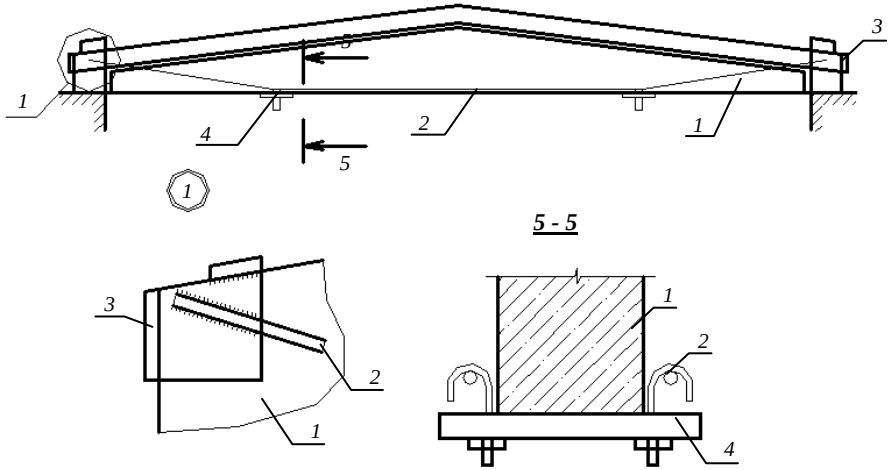
1 - beam under strengthening; *2* - rolled angle hinge-rod chains; *3* - steel plate struts; *4* - channel supporting element-ties;*5* - plate with holes for load suspenders; *6* - round reinforcing steel restraining elements welded to supporting elements and forming grooves for struts

SETTING OF DOUBLE-TEE AND ANGLE PRESTRESSED STRUT-FRAME



1 - beam under strengthening; *2* - horizontal tension bar of double-tee strut-frame; *3* - sloping tension bar of angle strut-frame; *4* - supporting unit of strut-frame; *5* - support for channel turnbuckle set on mortar; *6* - stiffening rib; *7* - square element-nut welded to strut-frame stressing screw-support with square thread; *8* - reinforcing fabric; *9* - space filled with cement-sand mortar after strut-frame

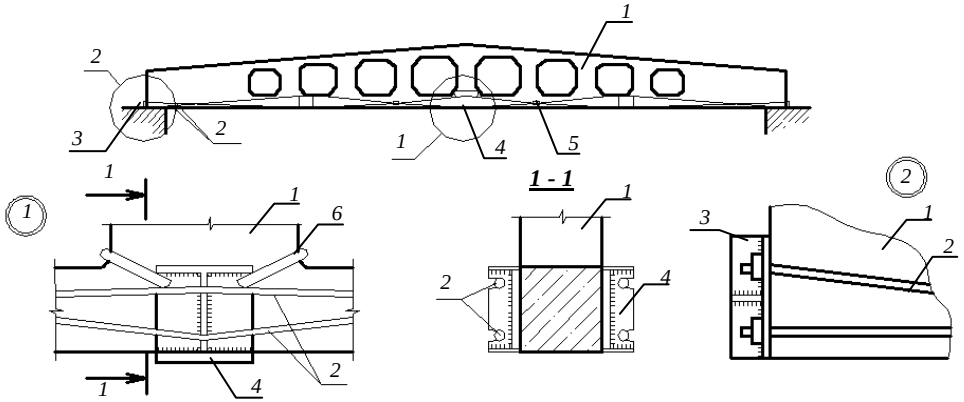
SETTING OF PRESTRESSED STRUTTED TIES



1 - beats under strengthening; *2* - strutted tie; *3* - bearing base; *4* - stressing device

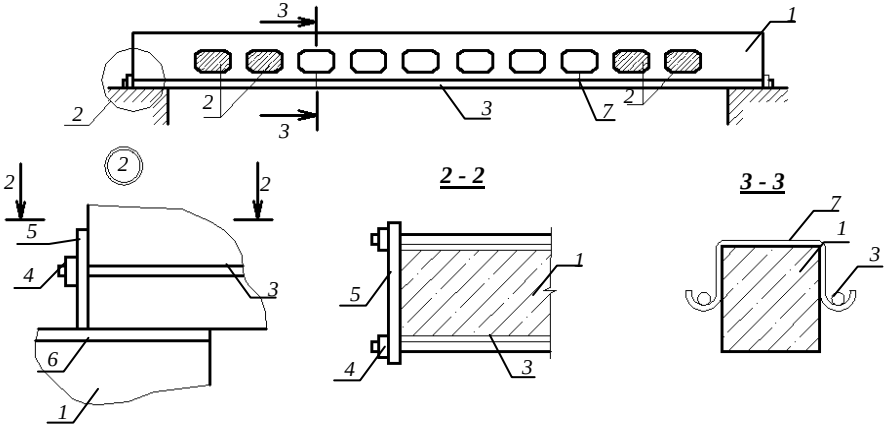
STRENGTHENING OF REINFORCED CONCRETE ROOF BEAMS

SETTING OF HORIZONTAL PRESTRESSED TIE



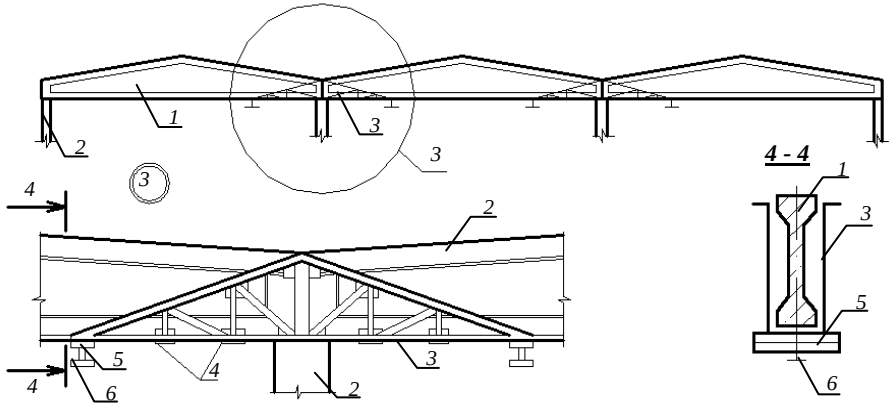
1 - beam under strengthening; *2* - reinforcing steel horizontal tie; *3* - bearing unit of tie; *4* - spacer of tie elements bands; *5* - stirrupjigs

SETTING OF PRESTRESSED TIES AND FILLING THE HOLES WITH CONCRETE



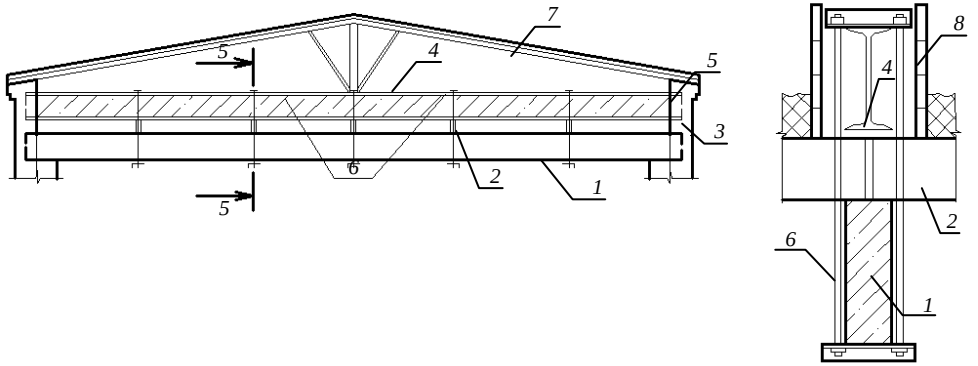
1 - beam under strengthening; *2* - holes filled with B-35 class concrete; *3* - A-III class prestressed tie 25-40 mm in diameter; *4* - nuts for tensioning; *5* - butt supporting sheet; *6* - support cast-in item; *7* - suspenders

SETTING OF RELIEVING BRACKETS



1 - beam under strengthening; *2* - columns; *3* - angle relieving brackets; *4* - connections along the bottom chord of brackets; *5* - supporting beam;6-tension screw

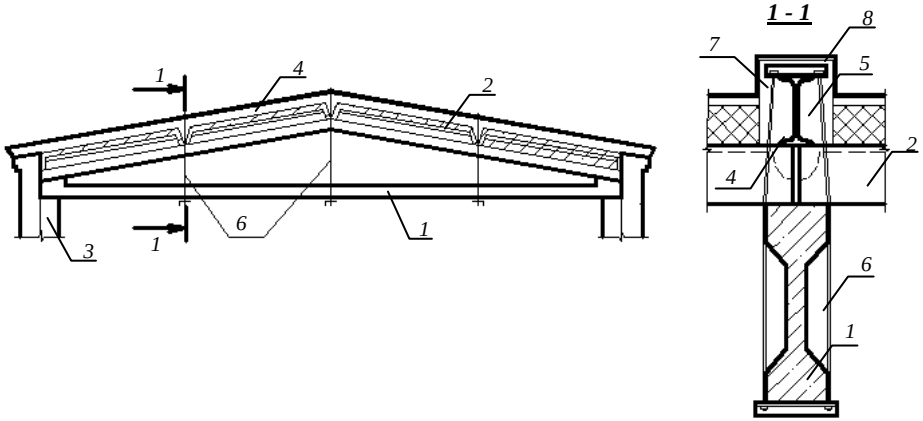
SETTING OF SUSPENDER TO RELIEVING BEAMS PLACED IN ROOF SPACE



1 - beam under strengthening; *2* - roof slabs; *3* - brick walls; *4* - metal relieving beam resting on walls; *5* - recesses cut out in walls for setting the relieving beams (to be packed with brick after setting the beams); *6* - tension bar and angle suspenders passed through interslab joints; *7* - roof

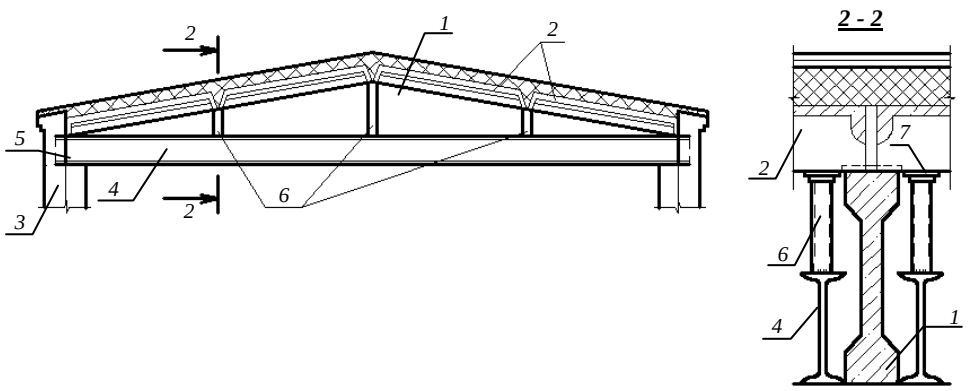
STRENGTHENING OF REINFORCED CONCRETE ROOF BEAMS

SETTING OF SUSPENDER TO RELIEVING BEAMS PLACED ON ROOF SLAB



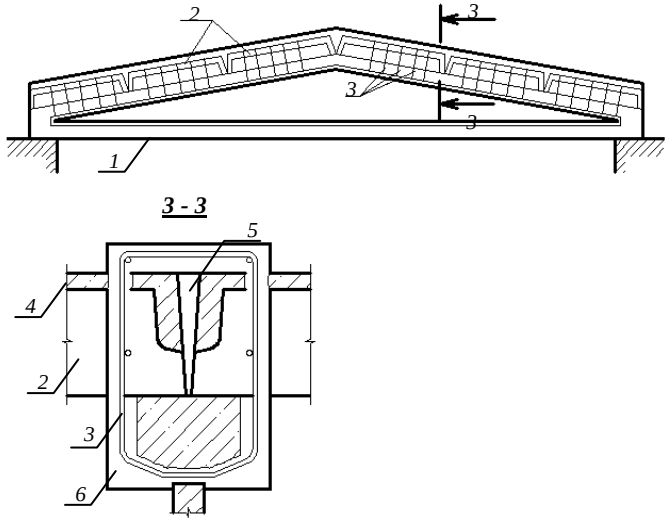
1 - beam under strengthening; *2* - roof slabs; *3* - brick walls; *4* - relieving metal beam with bend in span mid and with supports on walls; *5* - holes in beam web for stirrups; *6* - tension bar and angle suspenders in interslab joints; *7*- concrete for grouting the relieving beam; *8* - membrane waterproofing of concreted relieving beam

POSITIONING OF RELIEVING BEAMS



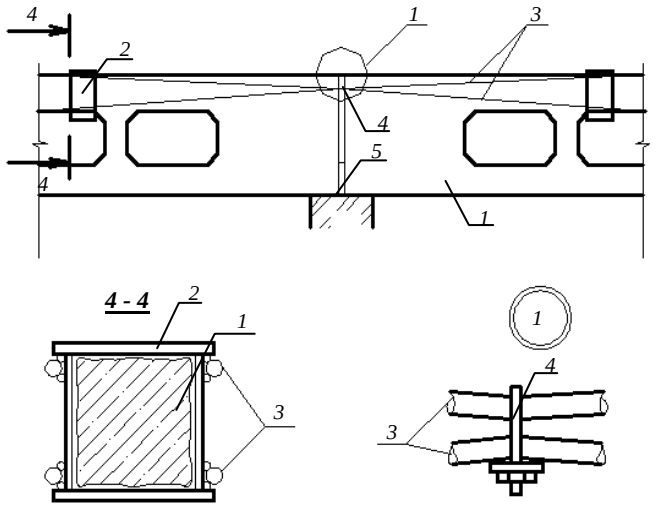
1 - beam under strengthening; *2* -roof slabs; *3* -brick walls; *4* -relieving metal beams resting on walls; *5* - recesses cut out in walls for getting the relieving beams (to be packed with brick after set-ting the beams); *6* - metal posts (tube, angle or channel box) welded to relieving beams and cast-in items of slabs after driving the wedges; *7* - metal plates-wedges for engaging relieving beams into work

ACHIEVING OF FLOOR SLABS JOINT WORK BY ARRANGING REINFORCED CONCRETE YOKE



1 - beam under strengthening; *2* - roof slabs; *3* - 10-14 mm diameter reinforcement stirrups; *4* - holes in slab flanges for stirrups; *5* - holes in beam web for stirrups; *6* - yoke concrete

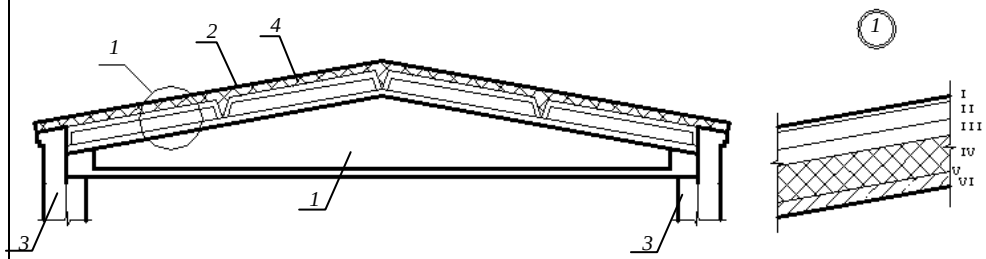
SETTING OF SUSPENDER TO RELIEVING BEAMS PLACED ON ROOF SLAB



1 - beams under strengthening; *2* - bracing sheet metal stirrups placed on mortar on prepared (clean-downed and hacked) surface; *3* -reinforcing steel ties welded to stirrups; *4* - bands; *5* - interbeam joints wedged out by steel plates

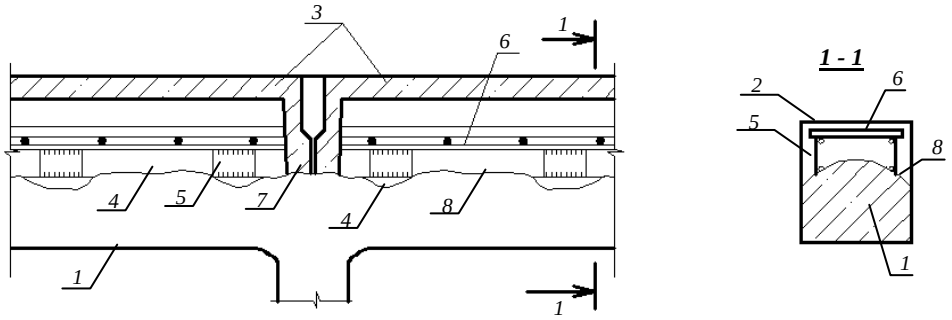
STRENGTHENING OF REINFORCED CONCRETE ROOF BEAMS

LIGHTENING OF ROOF STRUCTURE



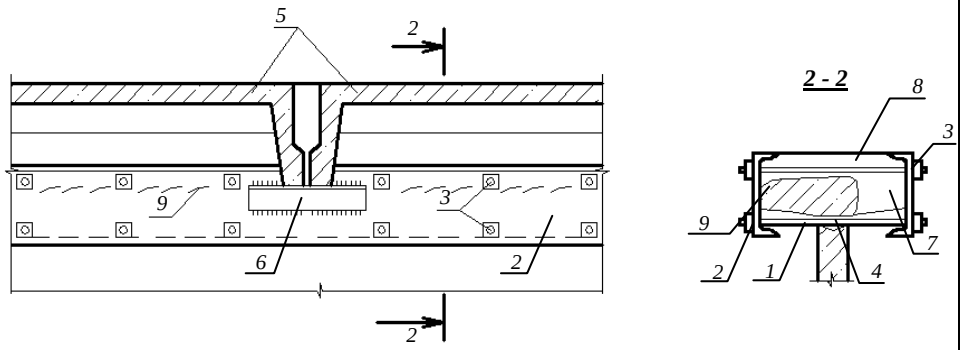
1 - beam under strengthening; *2* - roof slabs; *3* - brick walls; *4* - lightened roof structure; *I* – water-proof mat (3-4 courses of roofing felt on bituminous mastic); *II* - asbestos-cement flat sheet 8mm thick (joints between the sheets should be glued with burlap with bituminous mastic); *III*- leveling course of cement-sand mortar 15mm thick; *IV* - warmth keeping lagging (fibrous board, rigid mineral wool board, polystyrene, etc.); *V* - vapour insulation in the form of two

ARRANGEMENT OF REINFORCED CONCRETE YOKE ALONG THE TOP CHORD



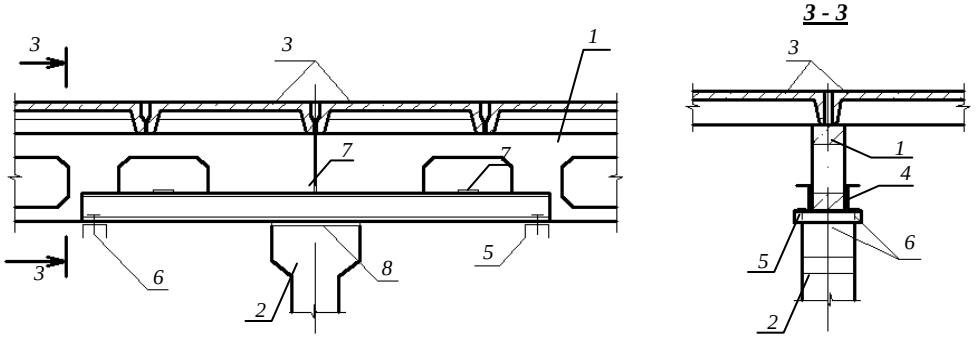
1 - top chord of lattice beam under strengthening; *2* - reinforced concrete yoke of strengthening; *3* - roof slabs; *4* - exposed reinforcement of beam top chord; *5* - metal plates welded to exposed reinforcement of beam top chord; *6* - reinforcing cage welded to plates; *7* - interslab joint in supporting section filled with concrete or steel plates; *8* - beam top chord surface prepared for concreting (cleandowned and hacked)

ARRANGEMENT OF METAL YOKE UNDER TOP CHORD LOCAL STRENGTHENING



1 - top chord of beam under strengthening; *2* - channels of strengthening yoke; *3* - coupling bolts; *4* - holes for bolts drilled in beam web; *5* - angle welded to channel in point notched for slab ribs; *6* - damaged section of flange overhang; *7* - concrete grouting; *8* - beam top chord surface prepared for concreting (cleandowned and hacked)

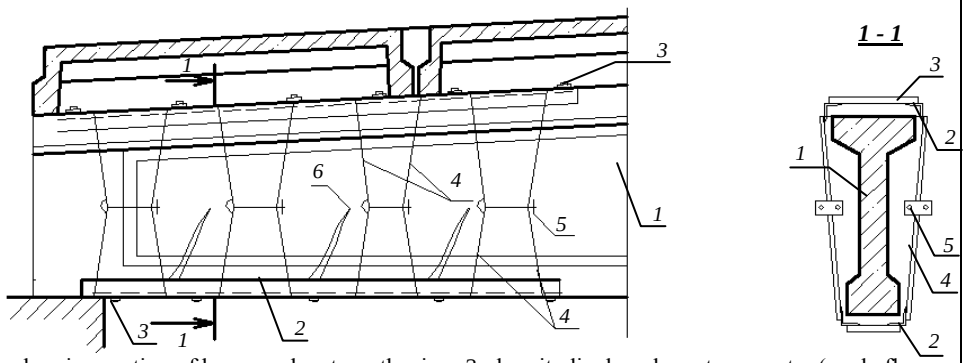
PLACING OF RELIEVING CANTILIVER BEAMS



1 - beam under strengthening; *2* - column; *3* - roof slabs; *4* - channel relieving cantilever beams supporting on column overhangs; *5* - channel bearing beam; *6* - bolts; *7* - cross plank-ties; *8* - aligning plate

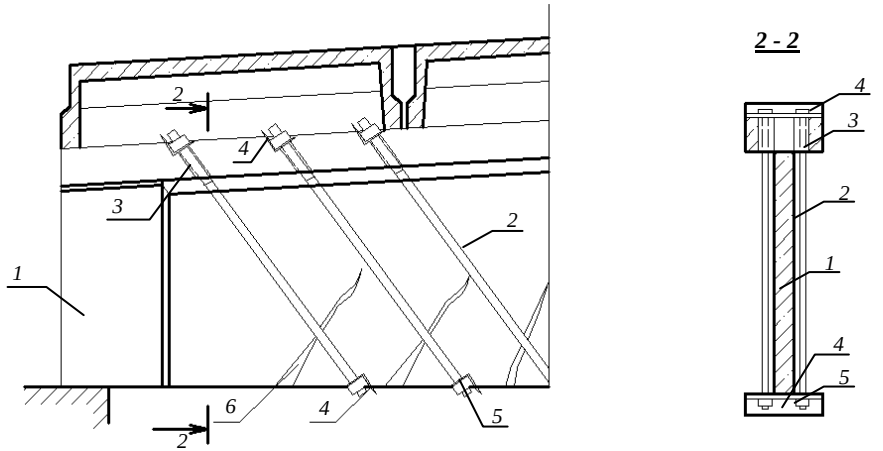
STRENGTHENING OF BEARING SECTIONS OF REINFORCED CONCRETE ROOF BEAMS

SETTING OF PRESTRESSED CROSS RODS IN BEARING SECTIONS



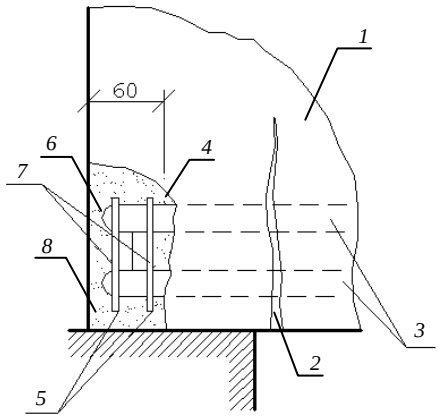
1 - bearing section of beam under strengthening; *2* - longitudinal angles set on mortar (angle flange should be notched in places of slab resting); *3* - connecting reinforced rods to be welded; *4* - prestressed cross rods of strengthening (should be tightened till closing up of cracks); *5* - bands; *6* - cracks in bearing section of beam

SETTING OF PRESTRESSED SLOPING RODS IN BEARING SECTIONS



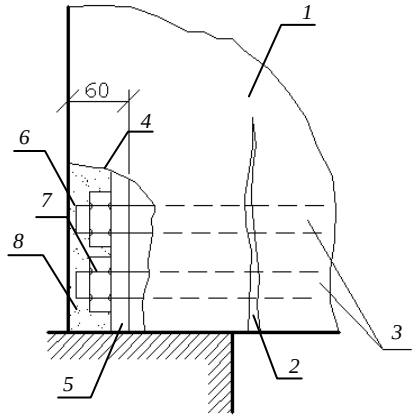
1 - bearing section of beam under strengthening; *2* - prestressed sloping rods of strengthening; *3* - holes drilled in beam flange for sloping rods; *4* - cross angles placed on mortar in cut grooves; *5* - nuts for rods tightening (till closing up of cracks); *6* - cracks in bearing section of beam

FORMATION OF ANCHOR HEADS WITH TENSION WEDGES IN BEARING SECTIONS



1 - beam under strengthening; *2* - crack in bearing section of beam; *3* - principle reinforcement of beam under strengthening; *4* - concrete cut in beam to the depth of about 60 mm; *5* - plates with holes placed on exposed reinforcement; *6* - formed anchor heads; *7* - late-wedges for tensioning (to be wedged out till closing up of cracks); *8* - protective concrete layer

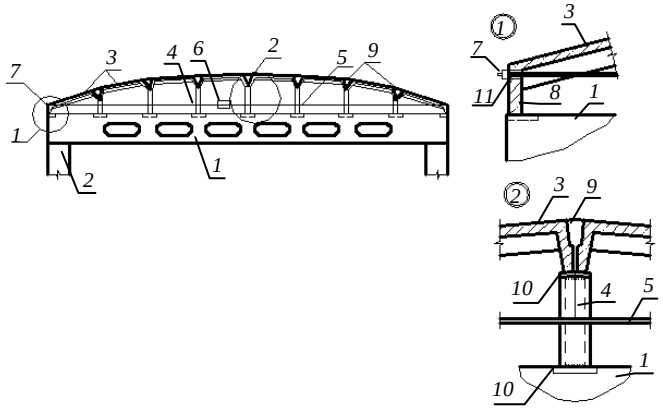
SETTING OF ANCHOR NUTS IN BEARING SUCTIONS



1 - beam under strengthening; *2* - crack in bearing section of beam; *3* - principle reinforcement of beam under strengthening; *4* - concrete cut in beam butt to the depth of about 60 mm; *5* - bearing plate with holes; *6* - screw thread on exposed principle reinforcement ends; *7* - tightening nuts (to be tightened till closing up of cracks); *8* - protective concrete layer

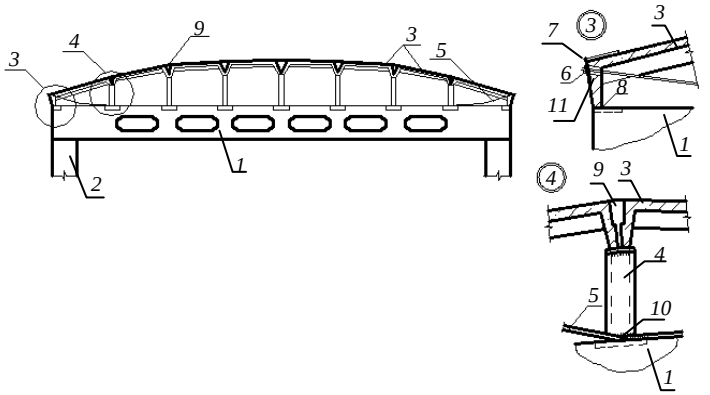
STRENGTHENING OF BEAM ROOFS BY THEIR RECONSTRUCTION INTO ARCHED ROOFS

TRANSFER OF THRUST TO TIES



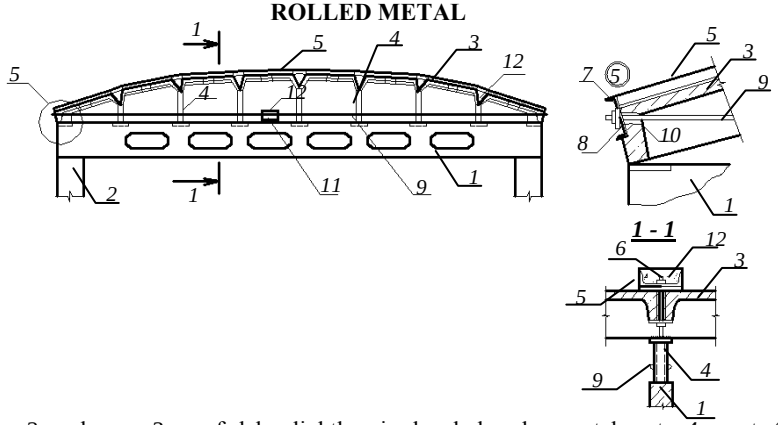
1 - roof beam; *2* - columns; *3* - root slabs slightly raised and placed on posts; *4* - metal posts (tube, angle and channel box); *5* - reinforcing steel tie; *6* - coupling for tensioning the tie; *7* - washer; *8* - V-shaped plate, *9* - concrete for grouting the joints between slabs; *10* - welding; *11*- holes in slab ribs for setting the ties

TRANSFER OF THRUST THROUGH TIES TO STRENGTHENED BEAMS



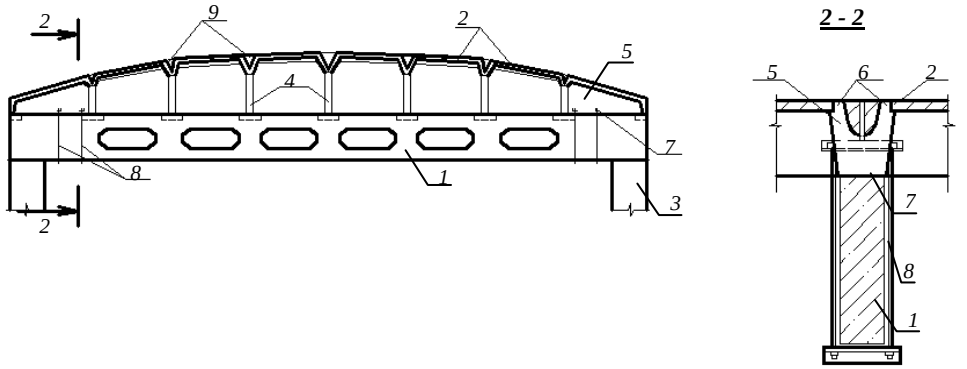
1 - roof beam; *2* - columns; *3* - roof slabs slightly raised and placed on posts; *4* - metal posts (tube, angle or channel box) welded to cast-in items of beams and slabs; *5* - reinforcing steel tie welded to cast-in items of beam; *6* - nut for tensioning the tie; *7* - angle; *8* - V-shaped plates; *9* - concrete for grouting the joints between slabs; *10* - welding; *11* - holes in slab ribs for setting the ties

ARRANGEMENT OF EDGE MEMBERS AND DIAPHRAGMS OF ROOF SLABS AND ROLLED METAL



1 - roof beam; *2* - columns; *3* - roof slabs slightly raised and placed on metal posts; *4* - posts (tube, angle or channel box) welded to beam and slab cast-in items; *5* - upper chord of channel diaphragm placed on slabs by means of mortar base course; *6* - coupling bolts fixed in interslab joints; *7* - channel edge element welded to channel chord; *8* - V-shaped plates; *9* - reinforcing steel tie; *10* - hole for tie in the slab; *11* - coupling for tensioning the tie; *12* - concrete for grouting the joints between slabs and upper chord of diaphragm (channel)

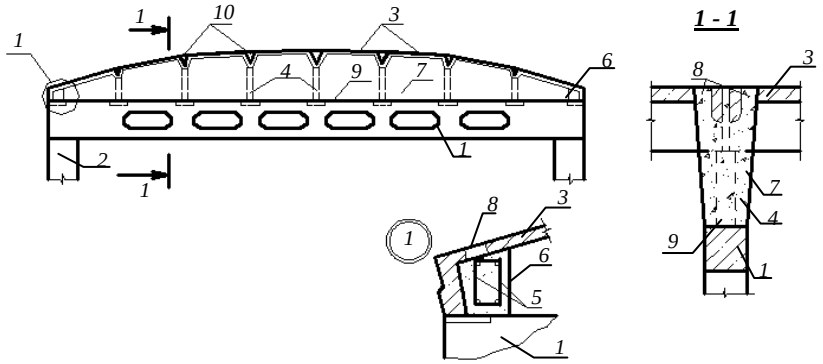
TRANSFER OF THRUST THROUGH CONCRETE KEYS TO STRENGTHENED BEAMS



1 - roof beam; *2* - roof slabs slightly raised and placed on posts; *3* - columns; *4* - metal posts (tube, angle, or channel box) welded to cast-in items of beams and slabs; *5* - concrete keys; *6*- holes in edge slab flanges for placing concrete keys; *7* - tension bar and angle bands; *8* - concrete for grouting the joints between slabs

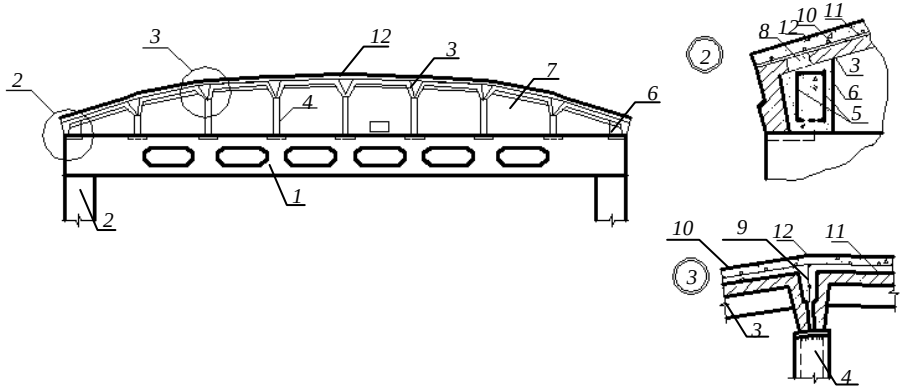
STRENGTHENING OF BEAM ROOFS BY THEIR RECONSTRUCTING INTO SHORT CYLINDRICAL SHELLS

ARRANGEMENT OF CAST-IN-PLACE CONCRETE EDGE MEMBERS AND DIAPHRAGMS



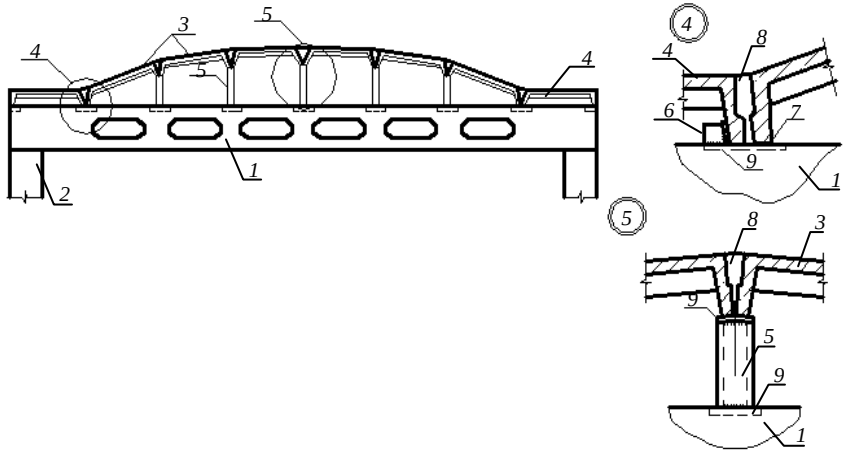
1 - roof beam; *2* - columns; *3* - roof slabs slightly raised and placed on metal posts; *4* - posts (tube, angle or channel box) welded to beam mid slab cast-in items; *5* - reinforcing cages of edge member; *6* - cast-in-place concrete edge member; *7* - cast-in-place concrete diaphragm; *8* - holes in slab flanges for placing concrete; *9* - beam surface prepared for concreting (cleandowned and hacked); *10* - interslab joints filled with concrete

ARRANGEMENT OF CAST-IN-PLACE CONCRETE EDGE MEMBER, KEYS AND SLABS



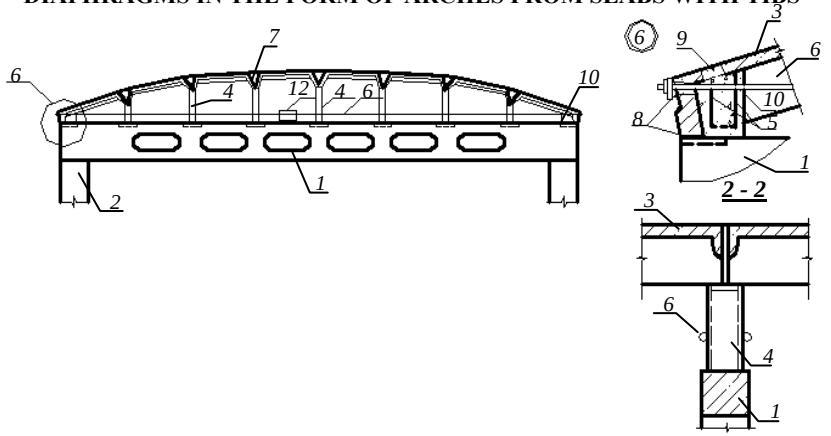
1 - roof beam; *2* - columns; *3* - roof slabs slightly raised and placed on metal posts; *4* - posts (tubs, angle or channel box) welded to beam and slab cast-in items; *5* - reinforcing cages of edge member; *6* - edge member; *7* - concrete keys; *8* - hole in slab flange for concreting the edge member and keys; *9* - rein-forcing cages placed in interslab joints; *10* - reinforcing fabric; *11* - slab surface prepared for concreting (hacked, cleandowned); *12* - 50 mm thick cast-in-place concrete layer

TRANSFER OF THRUST THROUGHT EDGE SLABS TO STRENGTHENED BEAMS



1 - roof beam; *2* - columns; *3* - roof slabs slightly raised and placed on posts; *4* - edge slabs additionally welded to cast-in items of beams and slabs; *5* - metal posts (tube, angle or channel box) welded to cast-in items of beams and slabs; *6* - additional supports welded to cast-in items of beams; *7* - V-shaped plate; *8* - concrete for grouting the joints between slabs; *9* - welding

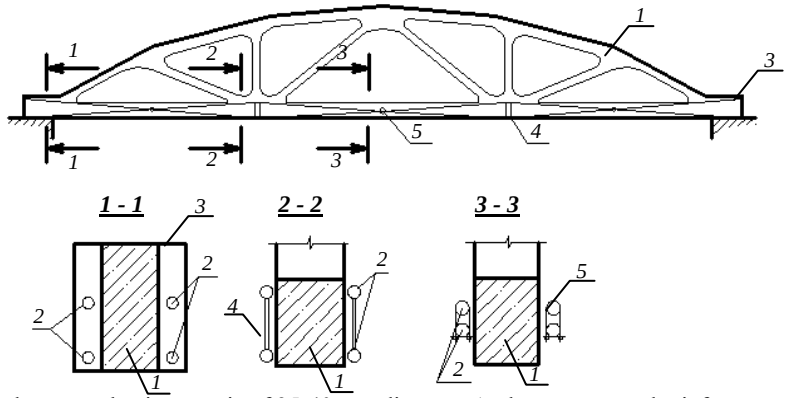
ARRANGEMENT OF CAST-IN-PLACE CONCRETE EDGE MEMBERS AND DIAPHRAGMS IN THE FORM OF ARCHES FROM SLABS WITH TIBS



1 - roof beam; *2* - columns; *3* - roof slabs slightly raised and placed on metal posts; *4* - posts (tubs, angle or channel box) welded to beam and slab cast-in items; *5* - reinforcing cages of edge member; *6* - rein-forcing steel tie; *7* - hole in the slab for tie; *8* - Y-shaped plates; *9* - holes is slab flange for concreting the edge member; *10* - east-in-place concrete edge member; *11* - interslab joints filled with concrete; *12* - coupling for tensioning the ties

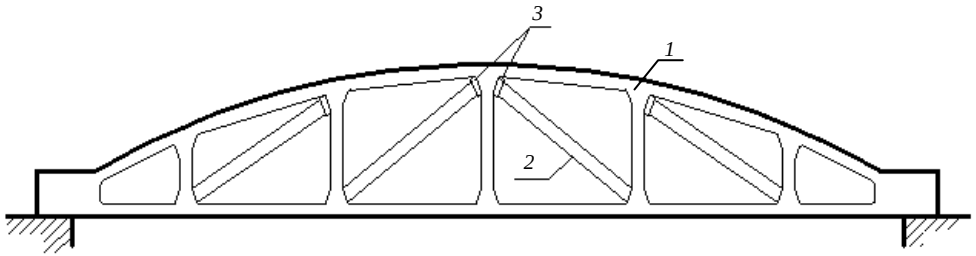
STRENGTHENING OF REINFORCED CONCRETE ROOF TRUSSES

STRENGTHENING OF BOTTOM CHORD BY SETTING PRESTRESSED REINFORCING STEEL TIE



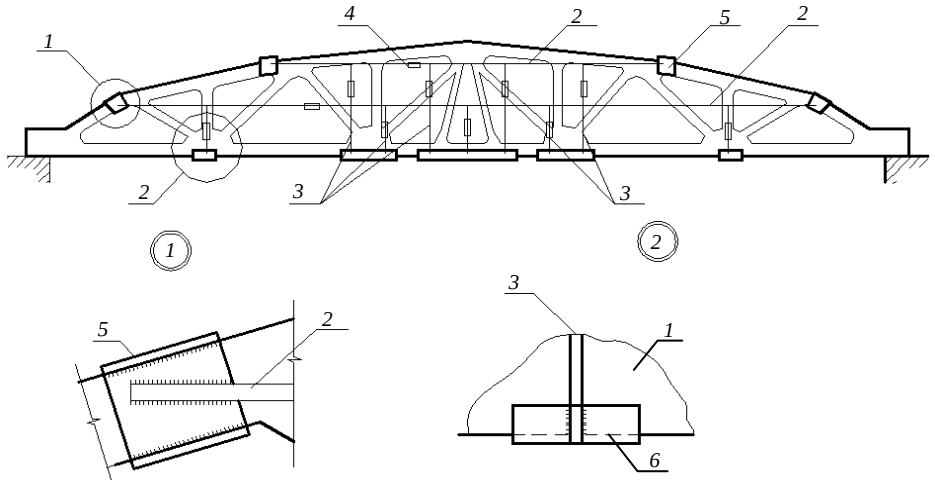
1 - truss under strengthening; *2* - tie of 25-40 mm diameter A-class prestressed reinforcement; *3* - butt bearing sheet; *4* - strut; *5* - band

SETTING OF DIAGONAL SUB-STRUTS



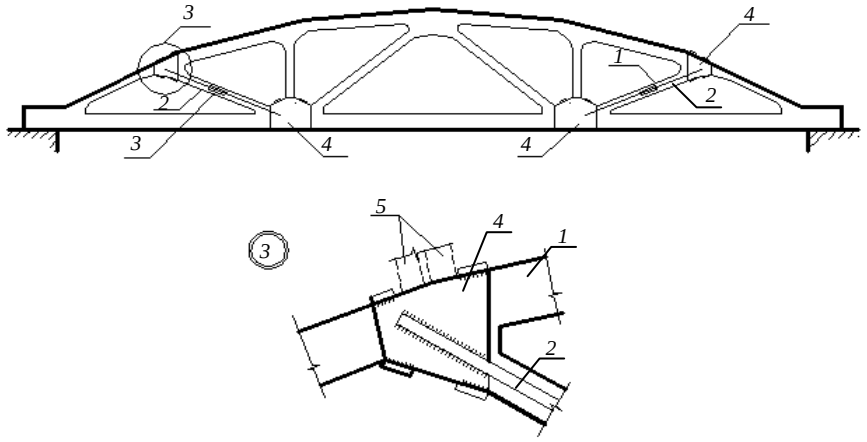
1 - open-frame truss under strengthening; *2* - diagonal sub-struts (reinforced concrete, rolled metal); *3* - elements for engaging sub-struts into the joint work (wedges, flat jacks, inserts of expanding cement concrete)

STRENGTHENING OF TRUSSES BY SETTING A SYSTEM OF REINFORCING STEEL TIES



1 - truss under strengthening; *2* - reinforcing steel ties; *3* - reinforcing steel suspenders; *4* - tension couplings; *5* - sheet metal bracing stirrup; *6* - channel bearing elements (should be placed on mortar)

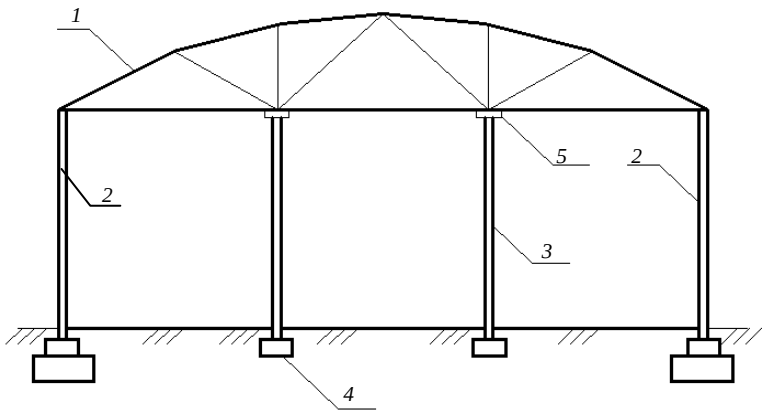
STRENGTHENING OF TENSIONED STRUTS BY SETTING REINFORCING STEEL TIES



1 - tensioned truss struts under strengthening; *2* - reinforcing steel ties; *3* - tension couplings; *4* - bracing stirrups of sheet metal and scabs; *5* - roof slab ribs

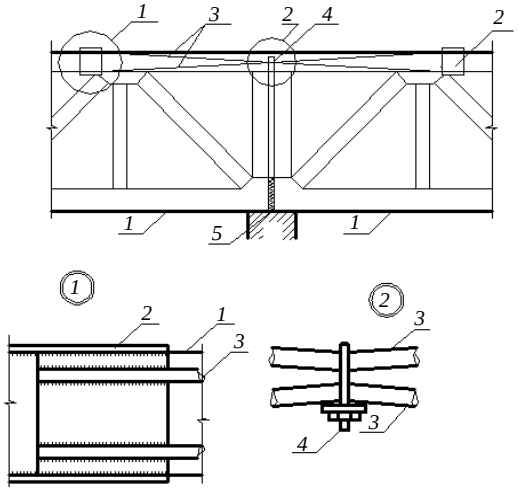
STRENGTHENING OF REINFORCED CONCRETE ROOF TRUSSES

SETTING OF ADDITIONAL SUPPORTS



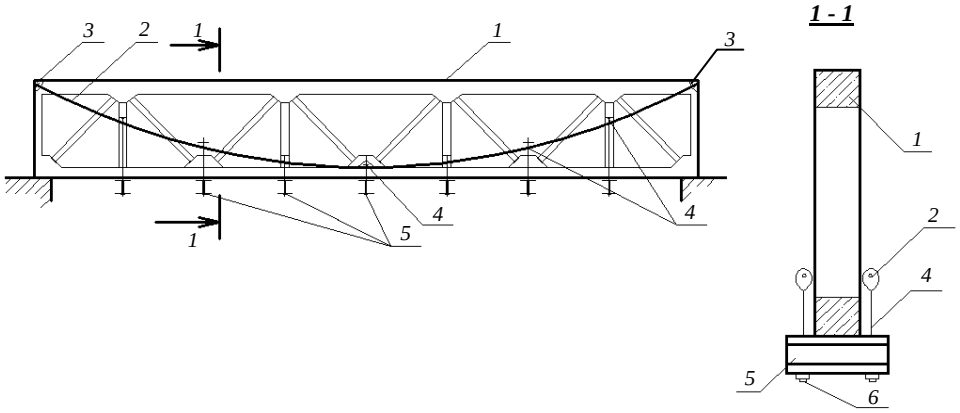
1 - truss under strengthening; *2* - existing columns; *3* - additional supports-posts put under intermediate truss units; *4* - foundation under additional supports; *5* - fittings for engaging additional supports into the joint work (wedges, flat jacks, screws, etc.)

ACHIEVING OF CONTINUITY



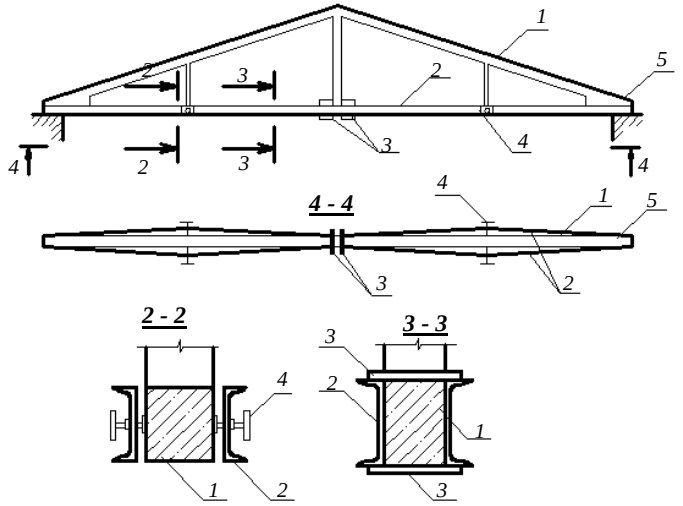
1 - trusses under strengthening; *2* - bracing stirrups of sheet metal; *3* - reinforcing steel ties; *4* - band; *5* - joint between trusses under strengthening wedged out by steel plates

SETTING OF HINGE-ROD CHAIN



1 - truss under strengthening; *2* - hinge-rod chain (reinforcing rode, tendons); *3* - chain attachment unit at the end of the truss; *4* - suspenders attached to chain by hinges from one side and thread from the other side; *5* - supporting elements in the form of channel beams under truss units; *6* - tightening nuts

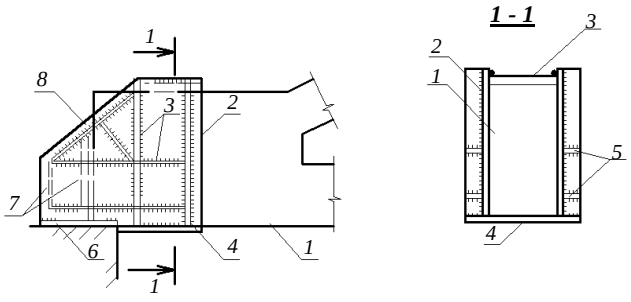
STRENGTHENING OF BOTTOM CHORD BY SETTING PRESTRESSED CHANNEL TIE



1 - truss under strengthening; *2* - prestressed channel tie; *3* - scabs; *4* - strut screws; *5* - butt bearing sheet

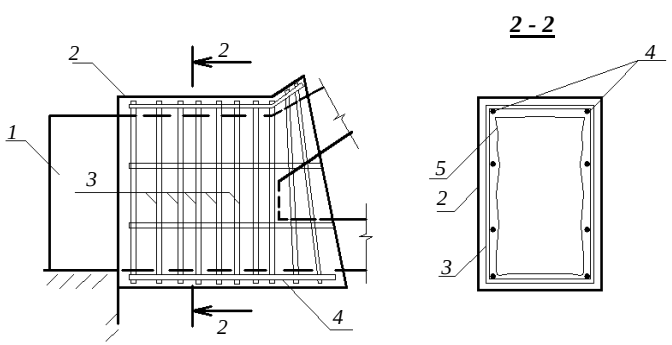
STRENGTHENING OF REINFORCED CONCRETE TRUSS UNITS

ARRANGEMENT OF METAL YOKE FOR LENGTHENING THE BEARING SECTIONS OF TRUSSES



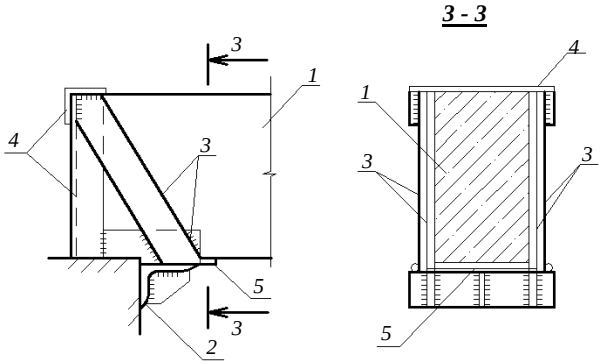
1 - bearing connection of truss; *2* - side sheets of yoke; *3* - top sheet of yoke; *4* - bottom sheet of yoke; *5* - stiffening ribs; *6* - supporting sheet; *7* - back vertical connecting sheets; *8* - clearance filled with concrete

ARRANGEMENT OF REINFORCED CONCRETE YOKE ON BEARING CONNECTIONS



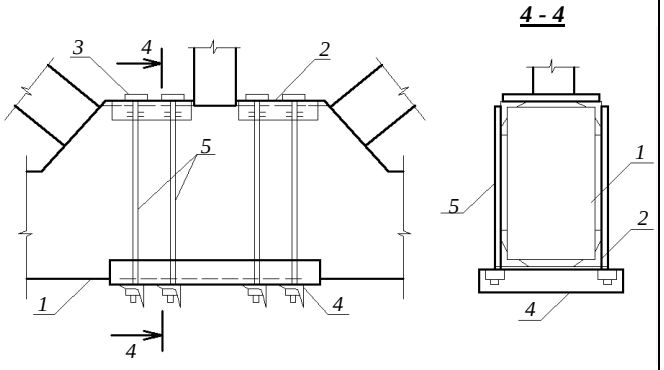
1 - bearing connection of truss; *2* - reinforced concrete yoke; *3* - 8-12 mm diameter closed cross stirrups of yoke; *4* - 12-14 mm diameter longitudinal reinforcement of yoke; *5* - bearing connection surface prepared for concreting (cleandowned and hacked)

POSITIONING OF SUPPORTING PROP UNDER BEARING CONNECTIONS



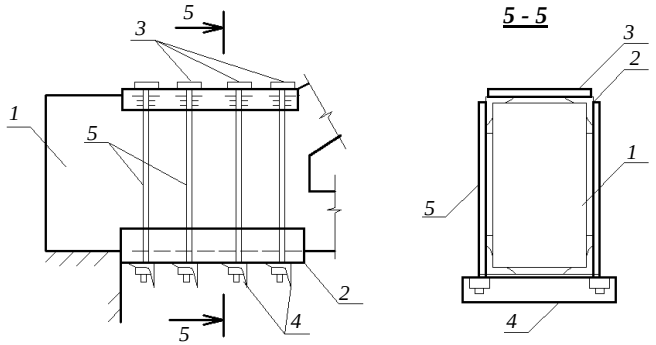
1 - bearing connection of truss; *2* - supporting prop with stiffening ribs; *3* - plate suspender of prop; *4* - supports for fixing the angle suspenders; *5* - metal plate-wedges for engaging the props into work

ARRANGEMENT OF METAL YOKE ON INTERMEDIATE UNIT



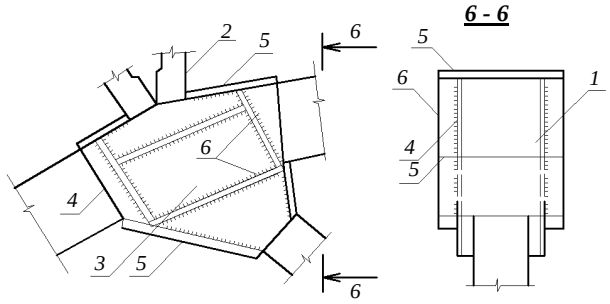
1 - truss intermediate unit; *2* - yoke angles; *3* - cross scabs; *4* -connecting cross angle-planks; *5* - coupling bolts with nuts

ARRANGEMENT OF METAL YOKE ON BEARING CONNECTIONS



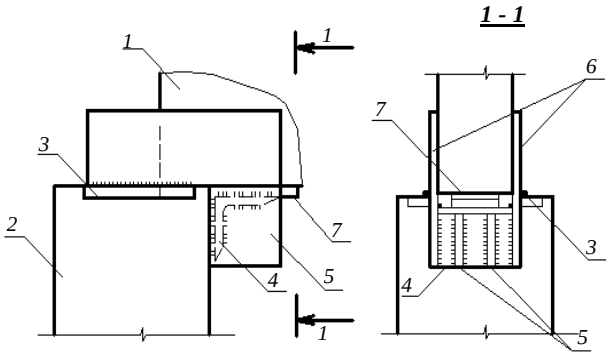
1 - bearing connection of truss; *2* - yoke angles; *3* - cross scabs; *4* -connecting cross angle-planks; *5* - coupling bolts with nuts

ARRANGEMENT OF METAL YOKE FOR STRENGTHENING THE INTERMEDIATE UNITS



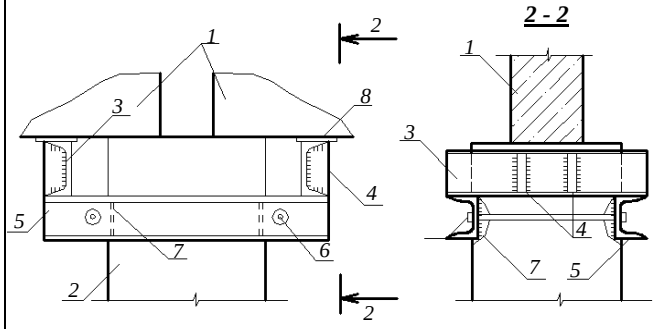
1 - truss intermediate unit; *2* - roof slabs; *3* - metal yoke placed on cement-sand mortar; *4* - side sheets of yoke cut along unit contour; *5* - connecting sheets of yoke; *6* - stiffening ribs

POSITIONING OF SUPPORTING PROPS BY MEANS OF PLATE-JIGS



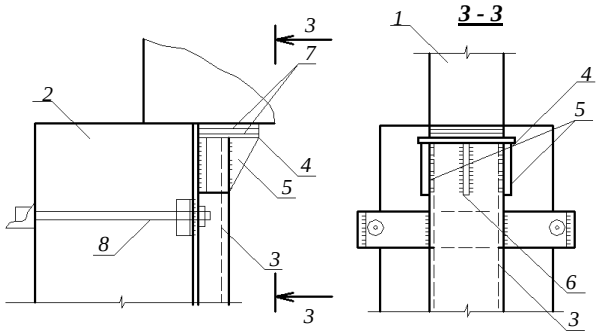
1 - displaced roof structure; *2* - column; *3* - column cast-in item; *4* - supporting angle prop; *5* - stiffening ribs; *6* - plate-jigs welded to supporting prop and column cast-in item; *7* - plate-wedges engaging props into work

POSITIONING OF SUPPORTING CHANNEL PROPS



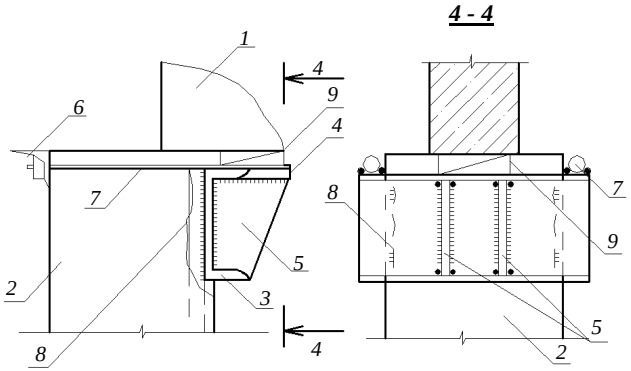
1 - displaced roof structures; *2* - column; *3* - supporting channel prop; *4* - stiffening ribs; *5* - support of channel props; *6* - coupling bolts; *7* - exposed principle reinforcement for welding prop supports; *8* - plate-wedges engaging props into work

POSITIONING OF SUPPORTING PROPS BY MEANS OF POSTS



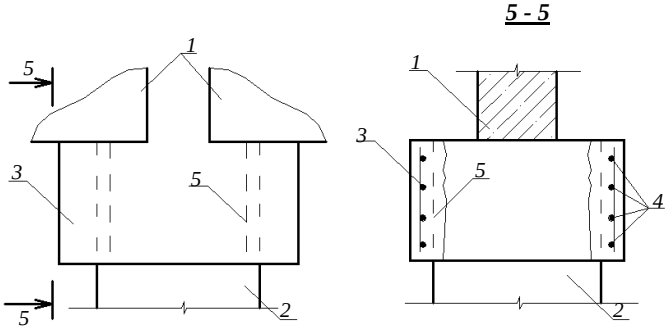
1 - displaced roof structure; *2* - column; *3* - channel post; *4*- supporting sheet of prop; *5* - side sheet of prop; *6* - stiffening rib; *7* - plate-wedges engaging the prop into work; *8* - stirrups for fixing the post

POSITIONING OF SUPPORTING CHANNEL PROPS



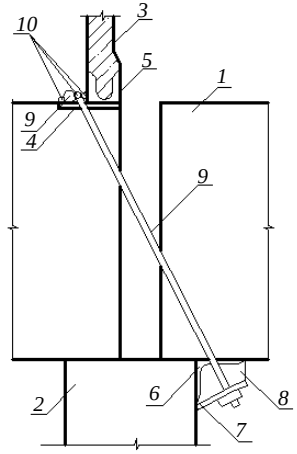
1 - displaced roof structure; *2* - column; *3* - supporting channel prop; *4* - supporting sheet of prop; *5* - stiffening ribs; *6* - anchor angle; *7* - coupling bolts; *8* - protective concrete layer out cut to expose principle reinforcement; *9* - plate-wedges engaging the prop into work

ARRANGEMENT OF REINFORCED CONCRETE YOKE-STIRRUPS



1 - displaced roof structures; *2* - column; *3* - reinforced concrete yoke-stirrup; *4* - horizontal closed reinforcing stirrups; *5* - protective layer of concrete cut along column perimeter

POSITIONING OF SUPPORTING PROPS BY MEANS OF TENSION BARS



1 - displaced roof structure; *2* - column; *3* - roof slab; *4* - cast-in item of roof structure; *5* - cast-in item of panel; *6* - supporting angle prop; *7* - plate-washer; *8* - stiffening ribs; *9* - tension bars with nuts; *10* - welding

1. Абелев М. Ю. Устройство свайных фундаментов: Учебное пособие / М. Ю. Абелев - М.: Стройиздат, 1979. – 40 с.
2. Абелев М. Ю. Авария фундаментов сооружений: Учебное пособие / М. Ю. Абелев - М.: Стройиздат, 1975. – 56 с.
3. Абелев Ю. М. Основы проектирования и строительства на просадочных макропористых грунтах. - 3-е изд., перераб. и доп. / Ю. М. Абелев, М. Ю. Абелев - М.: Стройиздат, 1979. – 271 с.
4. Абелев М. Ю. Технология ремонта фундаментов и усиление оснований сооружений: Учебное пособие / М. Ю. Абелев, А. М. Абелева -М.: Стройиздат, 1983. – 45 с.
5. Алексеев С. Н. Коррозионная стойкость железобетонных конструкций в агрессивной промышленной среде / С. Н. Алексеев , Н. К. Розенталь - М.: Стройиздат, 1976. – 205 с.
6. Альбрехт Р. Дефекты и повреждения строительных конструкций / Р. Альбрехт - М.: Стройиздат, 1979. – 205 с.
7. Ананьев В. П. Эксплуатация и ремонт зданий на лессовых просадочных грунтах / В. П. Ананьев, Я. Д. Гильман, М. П. Филатова, Н. В. Воляник - М.: Стройиздат, 1977. – 102 с.
8. Байков В. Н. Железобетонные конструкции / В. Н. Байков, Э. Е. Сигалов - М.: Стройиздат, 1985. – 728 с.
9. А. с. 742564 СССР. Способ усиления бетонных элементов, поврежденных трещинами / Ю. В. Барков, Б. В. Сендеров, Д. Л. Сергеев (СССР). - №742564; опубл.1980, Бюл. № 23
10. Белостоцкий О. Б. Реконструкция промышленных предприятий / О. Б. Белостоцкий, Б. С. Дамаскин, Т. П. Третяк – Киев.: Будивельник, 1986. – 142 с.
11. Беляков Ю. И. Реконструкция промышленных предприятий / Ю. И. Беляков, А. П. Снежков - К.: Высш. шк., Главное изд.,1988. – 256 с.
12. Бирюкова А. Н. Усиление деформированных опор / А. Н. Бирюкова //Анализ причин аварий и повреждений строительных конструкций - М.: Стройиздат, 1965. - с. 152 - 159.
13. Бойко М. Д. Дигностика повреждений и методы восстановления эксплуатационных качеств зданий / М. Д. Бойко - Л.: Стройиздат. Ленинград. отд-ние, 1975. – 336 с.
14. Бойко М. Д. Техническая эксплуатация зданий и сооружений: Учеб. пособие для вузов / М. Д. Бойко - Л.: Стройиздат, 1980. – 140 с.
15. А. с. 926722 СССР. Устройство для усиления колонн / М. Л. Бойко (СССР). - №926722; опубл. 1982, Бюл. № 12
16. Бойко М. Д. Техническое обслуживание и ремонт зданий и сооружений / М. Д. Бойко - Л.: Стройиздат, 1986. – 256 с.
17. Болдышев А. М. Снижение металлоемкости и повышение качества крупнопанельного домостроения в г. Томске (на примере 9-ти-этажных. домов серии 75) / А. М. Болдышев, А. И. Мальганов, В. С. Плевков – Томск: ЦНТИ, 1987. – 51 с.
18. Снижение металлооемкости и повышение качества железобетонных конструкций (На примере завода ЖБК-100 г. Томска) / [А. М. Болдышев, А. И. Мальганов, В. С. Плевков, Ю. А. Еремин]. – Т.: Томский ЦНТИ, 1987. – 74 с.
19. Болдышев А. М. Расчёт внецентренно загруженных железобетонных элементов / А. М, Болдышев, В. С. Плевков – Т.: Томский ИСИ, 1988. – 90 с.
20. Болдышев А. М. Шаблоны для расчёта прочности нормальных сечений железобетонных элементов / А. М, Болдышев, В. С. Плевков – Т.: Томский ЦНТИ, 1988 – 10 с.
21. Болдышев А. М. Прочность нормальных сечений железобетонных элементов / А. М, Болдышев, В. С. Плевков – Т.: Томский ЦНТИ, 1989. – 236 с.
22. Бурак Д. Я. Техническая экспертиза жилых домов старой застройки / Д. Я. Буряк, Г. М. Рабинович – Л.: Стройиздат, 1977. – 160 с.
23. Вадовска Г. Антикоррозийная зашита зданий / Г. Вадовска, В. Данилецкий, М. Мончинский - М.: Стройиздат, 1978. – 508 с.
24.А. с. 931905 СССР. Устройство для усиления подкрановой части колонны с консолями / М. А. Васильев (СССР) - № 931905; опубл. 1982, Бюл. № 20
25. Васильев Б. Д. Основания и фундаменты / Б. Д. Васильев -Л.: Стройиздат, 1955. – 383 с.
26. Вейц Р. И. Предупреждение аварий при строительстве зданий / Р. И. Вейц -Л.: Стройиздат, 1934. – 144 с,
27. А. с. 947364 СССР Устройство для усиления стен зданий / [В. С. Волга, М. И. Коляков, С. В. Савинский, С. В. Соломонов, А. Л. Ципис]. - №947364; опубл. 1982, Бюл. № 28
28. Ремонт кровель зданий сооружений / [А. И. Гармаш, И. П. Слипченко, А. В. Щербина, И. И. Рындин]. - Киев: Будивельник, 1984. – 125 с.
29. Гендель Э. М. Инженерные работы при реставрации памятников архитектуры / Э. М. Гендель - М.:Стройиздат, 1980. – 198 с.
30.Проектирование железобетонных конструкций. Справочное пособие / [А. Б. Голышев, В. Я.

Бачинский, В. П. Полищук и др.]. - Киев: Будивельник, 1985. – 496 с.
31. А. с. 771304 СССР. Способ усиления сжатых элементов / Е. В. Горохов, И. Р. Ружович, Д. И. Баландин (СССР). - № 771304; опубл.1980, Бюл. № 38
32. Грунау Э. Предупреждение дефектов в строительных конструкциях / Э. Грунау - М.: Стройиздат. 1980 – 214 с.
33. А.с. 607932 СССР. Способ усилений колонн / В. В. Гусельников (СССР) - №607932; опубл. 1987, Бюл. № 19
34. Далматов Б. И. Механика грунтов, основания и фундаменты: Учебник для вузов / Б. И. Далматов - М.:Стройиздат, 1981. – 319 с.
35. Далматов Б. И. Обследование оснований и фундаментов реконструируимых зданий. Текст лекций/ Б. И. Долматов, В. М. Улицкий – Л.: ЛИСИ, 1985. – 36 с.
36. Дворкин Ю. М. О назначении давления на песчаные основания при реконструкции зданий / Ю. М. Дворкин // Основания, фундаменты и механика грунтов. – 1982. - № 4. с 23 – 24.
37. Думашев Ю. Ф. Справочник по капитальному ремонту жилых и общественных зданий / Ю. Ф.Думашев, С. Д. Химунин - М.: Стройиздат, 1975. – 528 с.
38. А.с. 922257 СССР. Конструкция усиления железобетонных балок / О. А. Жильцов, В. В. Гапакто (СССР) - № 922257; опубл.1982, Бюл. № 15
39. А. с. 1074979 СССР. Способ заделки трещин в бетонных конструкциях / В. А. Заваров, М. М. Смирнов (СССР) - № 1074979; опубл.1984, Бюл. № 7
40. Зурнаджи В. И. Усиление оснований и фундаментов при ремонте зданий / В. И. Зурнаджи, М. П. Филатова - М.: Стройиздат, 1970. – 96 с.
41. Ильин Н. А. Техническая экспертиза зданий, поврежденных пожаром / Н. А. Ильин - М.: Стройиздат, 1983. – 200 с.
42. Инструкция по эксплуатации жилых зданий в Северной климатической зоне. - М.: Стройиздат, 1986. – 199 с.
43. Инструкция по проектированию конструкций панельных жилых зданий. - М.: Стройиздат, 1978. – 177 с.
44. Испытания железобетонных конструкций / [А. Г. Комар, Е. Н. Дубровин, Б. С. Кершнеренко, В. С. Заленский]. - М.: Высш. школа,1980. – 269 с.
45.Комисарчик Р. Г. Методы технического обследования ремонтируемых зданий / Р. Г. Комисарчик - М.: Стройиздат, 1975. – 88 с.
46. А.с. 337482 СССР Способ усиления железобетонных плит перекрытия / [В. К. Конев, И. И. Михеев, Е. Д. Косенко, Ю. Н. Соловьев, С. Т. Захаров] - № 337482; опубл. 1972, Бюл. № 15
47. Коновалов П. А. Основания и фундаменты реконструируемых зданий / П. А. Коновалов - М.: Стройиздат, 1980. – 136 с.
48. Коновалов П. А. Проблемы упрочнения оснований и усиление фундаментов реконструируемых зданий / П. А. Коновалов // Основания, фундаменты и механика грунтов. – 1986. - № 6. с. 3-5
49. Коновалов П. А. Основания и фундаменты реконструируемых зданий. -2-е изд., перераб. и доп./ П. А. Коновалов - М.: Стройиздат, 1988. – 287 с.
50. Консервация и реставрация памятников и исторических зданий. - М.: Стройиздат, 1978. – 320 с.
51. Коревицкая М. Т. Неразрушающие методы контроля качества железобетонных конструкций/ М. Т. Коревицкая - М.: Высш. школа, 1989. –79 с.
52. А. с. 573557 СССР Устройство для усиления несущих элементов строительных конструкций / [Е. Д. Косенков, Ю. Н. Соловьев, Ю. В. Манжелей, С. Т. Захаров, Р. Н. Красновский] - № 573557; опубл. 1977, Бюл. № 35
53. Крутов В. И. Основания и фундаменты на просадочных грунтах / В. И. Крутов - Киев: Будивельник, 1982. – 224 с.
54. Кузнецов Ю. Д. Обеспечение долговечности железобетонных конструкций при реконструкции промышленных предприятий / Ю. Д. Кузнецов, И. Н. Заславский - Киев: Будивельник, 1985. – 112 с.
55. Кулеев М. Т. Глубинное закрепление грунтов в строительстве: Учебвое пособие / М. Т. Кулеев, Я. Ситковский, А. Улятовский - Казань:Изд-во Казанского ун-та, 1983. – 76 с.
56. Купецкий В. Ремонт жилых зданий / В Купецкий - М.: Стройиздат, 1981. – 127 с.
57. Кутуков В. Н. Реконструкция зданий. Учеб. для строй. Вузов / В. Н. Кутуков - М.: Высш. школа, 1981. – 263 с.
58. Лапшин Ф. К. Основания и фундаменты в дипломном проектировании. Учебное пособие для вузов / Ф. К. Лапшин - Саратов: Изд-во Сарат. ун-та, 1986. – 224 с.
59. Лешинский М. Ю. Испытания бетона. Справ. пособие / М. Ю Лешинский - М.: Стройиздат, 1980. – 360 с.
60. Литвинов И. М. Укрепление и уплотнение просадочных грунтов в жилищном и промышленном строительстве / И. М. Литвинов - Киев:

изд-во Будивельник, 1977. – 288 с.
61. Лоссье А. Недостатки железобетона и их устранение / А. Лоссье - М.: Стройиздат, 1958. – 120 с.
62. Лихтарников Я. М. Расчет стальных конструкций / Я. М. Лихтарников, Д. В. Ладыженский, В. М. Клыков - Киев: Будивельник, 1984. – 366 с.
63. Обследование и испытание сооружений / [О. В. Лужин, А. Б. Злочевский, И. А. Горбунов, В. А. Волохов]. - М.: Стройиздат, 1987. – 263 с.
64. Малышев М. В. Прочность грунтов и устойчивостъ оснований сооружений / М. В. Малышев - М.: Стройиздат, 1980. – 136 с.
65. Малышков А. М. Эксплуатация и ремонт зданий гражданской авиации / А. М. Малышков, Ю. Я. Берлин - М.: Транспорт, 1981. – 222 с.
66. Мальганов А. И. Усиление железобетонных и каменных конструкций зданий и сооружений / А. И. Мальганов, В. С. Плевков, А. И. Полищук – Томск: ТИСИ, 1987. – 57 с.
67. Мальганов А. И. Усиление железобетонных и каменных конструкций зданий и сооружений / А. И. Мальганов, В. С. Плевков, А. И. Полищук – Томск: ТИСИ, 1988. – 91 с.
68. Мальганов А. И. Усиление железобетонных и каменных конструкций зданий и сооружений / А. И. Мальганов, В. С. Плевков, А. И. Полищук – Томск: ЦНТИ, 1989. – 50 с.
69. Мальганов А. И. Усиление железобетонных и каменных конструкций зданий и сооружений / А. И. Мальганов, В. С. Плевков, А. И. Полищук – Томск: Изд-во Том. ун-та, 1989. – 88 с.
70. Мартемьянов А. И. Способы восстановления зданий я сооружений, поврежденных землетрясением / А. И. Мартемьянов, В. В. Шарин - М.: Стройиздат, 1978. – 204 с.
71. А. с. 613632 СССР. Устройство для усиления несущих конструкций / В. Г. Матвеев, А. И. Заикин, Г. И. Амелькин (СССР) - №613632; опубл. 1978, Бюл. № 41
72. А. с. 939695 СССР. Стойка для усиления простенков / Н. С. Мещеряков (СССР) - № 939695; опубл. 1982, Бюл. № 24
73. Михалко В. Р. Ремонт конструкций крупнопанельных зданий / В. Р. Михалко - М.: Стройиздат, 1986. – 312 с.
74. Милюков Д. А. Строительство и зашита жилых и гражданских зданий на подрабатываемых территориях / Д. А. Милюков, А. А. Петраков - Киев: Будивельник, 1981. – 104 с.
75. Михалко В. Р. Ремонт наружных стен из ячеистобетонных панелей / В. Р. Михалко, И. Г. Безлепкин - М.: Стройиздат, 1977 – 112 с.
76. Молотилов И. И. Теория и практика железобетона. Конструирование и расчет. ч. 1 / И. И. Молотилов – Томск: издат. ком ВТУЗов, 1931. – 1002 с.
77. Михно Е. П. Ликвидация последствий аварий и стихийных бедствий / Е. П. Михно -М.: Атомиздат, 1979. – 287 с.
78. А. с. 340762 СССР. Способ усиления несущих элементов строит. конструкций / [И. И. Михеев, В. Д. Косенков, С. Т. Захаров, В. К. Конев, Ю. Н. Соловьев, П. В. Ганжа] - № 340762; опубл. 1972, Бюл № 18
79. Коррозия бетона железобетона, методы их защиты / [В. М. Москвин, Ф. М. Иванов, С. Н. Алексеев, Е. А. Гузеев].- М.: Стройиздат, 1980. – 536 с.
80. А. с 987062 СССР. Железобетонная конструкция/ А. П. Новоселов (СССР) - № 987062;(СССР);опубл. 1983, Бюл № 1
81. Овчаров В. И. Зашита от разрушений конструкций знаний предприятий пищевой промышленности / В. И. Овчаров, Н. А. Демчинский - М.: Пищевая промышленность, 1980. – 208 с.
82. Онуфриев Н. М. Простые способы усиленния железобетонных конструкций промышленных зданий / Н. М. Онуфриев - Л.: Стройиздат, 1958. – 175 с.
83. Онуфриев Н. М. Усиление железобетонных конструкций в условиях действующих предприятий / Н. М. Онуфриев- Л.: Стройиздат, 1963.- 20с.
84.Онуфриев Н. М. Усиление железобетонных кон-трукций промышленных зданий и сооружений / Н. М. Онуфриев - Л.: Стройиздат, 1965. – 342 с.
85. Онуфриев Н. М. Исправлении дефектов изготовления и монтажа сборных железобетонных конструкций промышленных зданий / Н. М. Онуфриев - Л.: Стройиздат, 1971. – 158 с.
86. А. с. 617565 СССР. Способ усиления эксплуатируемой железобетонной балки / В. А. Осипов (СССР). - №617565; опубл. 1978, Бюл. № 28
87. А. с. 510576 СССР. Устройство для усиления железобетонной балки / В. А. Оскипов (СССР). - №510576; опубл. 1976, Бюл. № 14
88. Основание, фундаменты и подземные сооружения/ [М. И.Горбунов, В. Посадов, В. А. Ильичев, В. И. Крутов и др.; Под общ. ред. Е. А. Сорочана и Ю .Г. Трофименкова].- М.: Стройиздат, 1985. – 480 с.
89. Полищук А. И. Устройство оснований зданий и сооружений на лессовых просадочных грунтах / А. И. Полищук - Томск: изд-во Том. ун-та, 1985. – 47 с.
90. А. с. 1206400 СССР Способ заложения фунда-

мента строящегося здания / А. В. Пилягин , В. Е. Глушков (СССР). - № 1206400; опубл. 1986, Бюл. № 3
91. Пособие по проектированию бетонных и железобетонных конструкций из тяжелого и легкого бетона (к СНиП 2.03.01-84).-М.: Стройиздат, 1987.
92. Пособие по проектированию предварительно напряженных железобетонных конструкций из тяжелого и легкого бетона (к СНиП 2.03.01-84).-М.: Стройиздат, 1987.
93. Пособие по проектированию железобетонных ростверков свайных фундаментов под колоны зданий и сооружений (к СНиП 2.03.01-84).-М.: Стройиздат, 1985. – 51 с.
94. Пособие по проектированию оснований зданий и сооружений (к СНиП 2.02.01-83)/ НИИОСП им. Герсеванова.- М.: Стройиздат. 1986. – 415 с.
95. Попов Г. Т. Техническая экспертиза жилых зданий старой застройки / Г. Т. Попов, Л. Я Бурак . - Л.: Стройиздат, 1986. – 240 с.
96. Попов К. Н. Полимерные и полимерцементные бетоны, растворы и мастики / К. Н. Попов - М.: Высшая школа, 1987. – 72 с.
97. Порывай Г.А. Организация, планирование и управление эксплуатацией зданий / Г. А. Порывай - М.: Стройиздат, 1983. – 382 с.
98. Предупреждение деформаций и аварий зданий и сооружений/ [А. И. Работников, А. А. Михайлов, Б. М. Кованев и др., под ред. В. А. Лисенко]. - К.:Будивельник, 1984. – 120 с.
99.Почтовик Г. Я. Методы и средства испытания строительных конструкций / Г. Я. Почтовик, А. Б. Зяочевских, А. И. Яковлев - М.: Высшая школа, 1973. – 160 с.
100. Рекомендация по обследованию зданий и сооружений, поврежденных пожаром. - М.:Стройиздат, 1987. – 80 с.
101. Рекомендаций по определению технического состояния ограждающих конструкций при реконструкции промышленных зданий. - М.: Строй-издат, 1988. – 151 с.
102. Рекомендация по усилению монолитных конструкций зданий и сооружений горнодобывающей промышленности. - Донецкий Промстрой ИИпроект Госстроя СССР. – М.: Стройиздат, 1974. – 96 с.
103.Рекомендации но применению буроинъекционных свай / [Составители: Джантимиров Х.А., Вахолдин Б.В., Вронский А.В. и др.]. - М.: НИИОСП им. Герсеванова Госстроя, 1984. – 49 с.
104. Рекомендации по проектированию и устройству свайных фундаментов в условиях реконструкции предприятий – Уфа: Уфимскмй НИИпромстрой, 1987. – 43 с.
105. Рекомендации по проектированию стальных закладных деталей для железобетонных конструкций - М.: Строиздат, 1984. – 86 с.
106. Рекомендации по усилению каменных конструкций зданий и сооружений - М.: Стройиздат, 1984. – 35 с.
107. Рекомендации по применение защитноконструкционных полимеррастворов при реконструкции и строительстве гражданских зданий. - М.: Строиздат, 1986. – 112 с.
108. Ремонт жилых зданий. Несущие и ограждающие конструкции. Сокр. пер. с польск. Е. Б. Долгова / В. Конецкий, Я. Ситковский, А. Улятовский: под редакцией А. Г. Ройтмана. - М.: Стройиздат, 1981. – 150 с.
109. Рибицки Р. Повреждение и дефекты строительных конструкций/ Р. Рибицки - М.: Стройиздат, 1982. – 432 с.
110. Рогонский В. А. Эксплуатационная надежность зданий / В. А. Рогонский, А. И. Кострiц, В. Ф. Шеряков - Л.: Стройиздат, Ленингр. отд-ние, 1983. – 280 с.
111. Ройтман А. Г. Деформация и повреждение зда-ний / А. Г. Ройтман - М.: Строиздат, 1987. – 159 с.
112. Ройтман А. Г. Ремонт и реконструкция жилых и общественных зданий / А. Г. Ройтман, Н. Г. Смоленская - М.: Стройиздат, 1978. – 319 с.
113. Романов С.В. Оборудование и технология для погружения свай вдавливанием. Информациионный листок / С. В. Романов, Ю. Н. Глущенко, Г. Я. Яременко - НИИСП Госстроя УССР, 1987. – 72 с.
114. Ротань В. Я. Ремонт и устройство перекрытий / В. Я. Ротань - Л.: Стройиздат, Ленингр. отд-ние, 1977. – 72 с.
115. Руководство по защите строительных материаллов и конструкций, работающих в агрессивных средах и различных климатических условиях -М.: Строиздат, 1974. – 207 с.
116. Руководство но проектированию фундаментов на естественном основании под коллоны зданий и сооружений промышленных предприятий - М.: Стройиздат. 1978. – 112 с.
117. Руководство по койструированию бетонных и железобетонных конструкций из тяжелого бетона (без предварительного напряжения) - М.: Стройиздат, 1978. – 174 с.
118. Руководство по защите лакокрасочными покрытиями строительных бетонных и железобетонных конструкций, работающих в газовлажных средах - М.: Строиздат, 1987. – 224 с.

119. Сенченок Н. М. Техническая эксплуатация жилых зданий (справочное пособие)/ Н. М. Сенченок - Киев: Будивельник, 1974. – 374 с.
120. Скрыль А. С. Справочник по антикоро-зийным работам в строительстве / А. С. Скрыль, С. П. Аралов - К.: Будивельник, 1986. - 192с.
121. Современные методы обследования зданий / [Н. Т. Смоленская, А. Г. Ройтман, В. Д. Кириллов, Л. А. Дудышкина, Э. М. Ширрина] - М.: Стройиздат, 1979. – 148 с.
122. Соколов В. К., Реконструкция жилых зданий / В. К. Соколов - М.: Моск. рабочий, 1982. – 204с.
123. Соколов В. К. Реконструкция / В. К. Соколов - М.: Стройиздат, 1986. – 248 с.
124. Соколович В. Е. Химическое закрепление грунтов / В. Е. Соколович - М.:Стройиздат, 1980.- 119 с.
125. Сотников С. Н. Проектирование и возведе-ние фундаментов вблизи существующих сору-жений: (Опыт строительства в условиях Северо-Запада СССР) / [С. Н. Сотников, В. Г. Симегин, В. П. Вершинин - под ред. С. Н. Сотникова]. - М.: Строиздат, 1986. – 96 с.
126. Сталеві конструкції. Норми проектування, виготовлення, і монтажу: ДБН В.2.6-163:2010 - [Чинний від 2011-12-01]. - К.: Мінрегіонбуд України, 2011. - 201 с.
127. Каменные и аркокаменные конструкции: СНиП П-22-81.-М.: Стройиздат, 1983. – 40 с.
128. Бетонні та залізобетонні конструкції: ДБН В.2.6-98:2009 - [Чинний від 2011. 07.01]. - К.: Мінрегіонбуд України, 2011. - 71 с.
129. Защита строительных конструкций от коррозии: СНиП 2.03.11-85.- М.: Строиздат, 1986.
130. Деревянные конструкции. Госстрой СССР: СНиП П-25-80 - М.: Стройиздат, 1982. – 65 с.
131. Основи та фундаменти споруд. Основні положення проектування: ДБН В.2.1-10-2009 - [Чинний від 01.07/2011]. - К.: Мінрегіонбуд України, 2011. – 107 с.
132. Основание зданий и сооружений. Госстрой СССР:СНиП 2.02.01-83 - М.:Стройиздат,1985.-40с.
133. Лысовой А. И Справочник по капитальному ремонту жилых зданий / А. И. Лысовой - Л.: Стройиздат, Ленингр. отд-ние, 1977. – 358 с.
134. Сорочан Е. А. Фундаменты промышленных зданий / Е. А. Сорочан - М.:Строиздат, 1986.-303 с.
135. Строительство и ремонт одаоэтажных домов: Пер. со словац. / [М. Дедек, Д. Долань, В. Гаек (рук. кол-ва) и др.]. - М.: Стройиздат, 1981. – 296 с.
136. Тетнор А. Н. Обследование и испытание сору-жений / А. Н. Тетнор, В. Н. Номеранев - К.: Высш. шк., 1988. – 207 с.
137. Тьери Ю. Ремонт зданий и усиление конструк-ций. Сокр.пер.с польск / Ю. Тьери, С. Залески - М.: Стройиздат, 1975. – 175 с.
138. Фалевич Б. Н. Проектирование каменных и крупнопанельных конструкций / Б. Н. Фалевич, К. Ф. Штритер - М.: Высшая школа. 1983. – 192 с.
139. Физдель И. А. Дефекты в конструкциях и сооружениях и методы их устранения / И. А. Физдель - М.: Строиздат, 1978. – 160 с.
140. Филимонов И. И. Технология и организация ремонтно-строительных работ: Учеб. для вузов по спец. "Коммунальное строительство" / И. И. Филимонов - М.: Высш.шк., 1988. – 479 с.
141. Хило Е. Р. Усиление железобетонных конструк-ций с изменением расчетной схемы и напряженного состояния / Е. Р. Хило, Б. С. Попович – Л.: Высш. шк.: Изд-во при Львовском ун-те, 1976. – 146 с.
142. Хило Е. Р. Усиление строительных конструк-ций / Е. Р. Хило, Б. С. Попович - Львов: Высш. шк.: Изд-во при Львовском ун-те, 1985. – 155 с.
143. Цитович Н. А Основания и фундаменты (краткий курс). Учебник для строит. вузов / [Н. А. Цитович, В. Г. Березанцев, Б. И. Далматов, М. Ю. Абелев - под ред. Н. А. Цытовича]. - М.: Строиздат. 1970. – 384 с.
144. А. с. 1036887 СССР. Устройство для усиления строительных конструкций / А. В. Цыганков (СССР). - № 1036887;опубл. 1983, Бюл № 31
145. Шайнев А. Н. Аварии в строительстве / А. Н. Шайнев - М.: Стройиздат, 1984.- 320 с.
146. Швец В. Б. Надежность оснований и фундамен-тов / В. Б. Швец, Б. Л. Тарасов, Н. С. Швец - М.: Стройиздат, 1980. – 158 с.
147. Швец В. Б. Усиление и реконструкция фунда-ментов / В. Б. Швец, В. И. Феклин, Л. К. Гинзбург - М.: Стройиздат, 1985. – 204 с.
148. Шведов Г. И. Инженерная геология, механика грунтов, основания и фундаменты.: Учеб. для вузов по спец. "Строительство" / Г. И. Шведов - М.: Высш. шк., 1987. – 296 с.
149. Фадеев А. Б. Подземные соружения: Учебное пособие для студентов спец-ти 1202-Промыш-ленное и гражданское строительство, специализации "Основания и фундаменты" / А. Б. Фадеев, В. В. Вабанов - Л.: ЛИСИ, 1987. – 145 с.
150. Рекомендации по укреплению водона-сыщенных слабых глинистых грунтов защело-чиванием – Уфа: Уфимский НИИпромстрой, 1987. – 58 с.
151. Болдырев Г. Г. Устойчивость и деформируе-

мость анкерных фундаментов / Г. Г. Болдырев - М.: Стройиздат, 1987. – 80 с.
152. Далматов Б. И. Механика грунтов, основания и фундаменты (включая специальный курс инженерной геологии).-2-е издание перераб. и доп. / Б. И. Долматов - Л.: Стройиздат, Ленингр. отдние, 1988. – 415 с.
153. Смороцинов М. Н. Струйная технология устройства противофильтрационных завес и несущих конструкций в грунте / М. Н. Смороцинов, В. Н. Корольков - М.: ВНИИИС Госстроя СССР, 1984. - Вып. 1 – 41 с.
154. Бунин А. Я. Набережные: Справ. Пособие / А. Я. Бунин, Г. А. Домина - М.: Стройиздат, 1979. – 287 с.
155. Бамбура А. М. Основні положення розрахунку бетонних та залізобетонних конструкцій по національному нормативному документу, що розробляється. Будівельні конструкції. Зб. наук. праць у 2-х томах / А. М. Бамбура, А. Я. Барашиков, О. Б. Гурківський - Київ: НДІБК, 2005. - Том 1. - С. 36-43.
156. Бамбура А. М. Расчет изгибаемых и внецентренно сжатых железобетонных элементов на основе упрощенных диаграмм деформирования. Бетон и железобетон - пути развития. Науч. пр. конф. в пяти книгах / А. М. Бамбура, А. Я. Барашиков – М.: НИИЖБ, 2005. - Том 2. - С. 312-318.
157. Мальганов А. И. Восстановление и усиление строительных конструкций аварийных и реконструируемых зданий: атлас схем и чертежей / А. И. Мальганов - Томск, 1990. - 316 с.
158. Рекомендации по оценке состояния и усилению строительных конструкций промышленных зданий и сооружений /НИИСК. - М.: Стройиздат, 1989. - 104 с.
159. Шилин А. А. Усиление железобетонных конструкций композиционными материалами / А. А. Шилин, В. А. Пшеничный, Д. В. Картузов - М.: Стройиздат, 2004. - 144 с.
160. Кокошуев П. В. Усиление безбалочного монолитного перекрытия / П. В. Кокошуев, А. И. Марков, Ю. И. Серая - М.: Стройиздат, 2000. - 153 с.
161. Малишев О. М. Визначення категорійності технічного стану будівельних конструкцій в залежності від природних та технологічних впливів. Науково-технічний збірник "Сучасні технології, матеріали і конструкції в будівництві" / О. М. Малишев, Н. О. Костира – В.: УНІВЕРСУМ- Вінниця. - 2012. - № 41. – с 39-46.
162. Технічне обстеження та нагляд за безпечною експлуатацією будівель та інженерних споруд. Навч. посіб / О. М. Малишев, В. Д. Віроцький, О. О. Нілов, О.В.Сергійчук, В.С. Бачинський, Н. О. Костира, Л. І. Лавриненко, М. А. Новгородський - К.: ДП «Головний навчально-методичний центр», 2001 - 705 с.
163. Безпека промислових підприємств. Загальні положення та вимоги: ДСТУ3273-95. - [Чинний від 01-07-1996]. - К.:Держстандарт України, 1995. - 44 с.
164. Спрощені розрахунки несучої здатності нормальних перерізів згинальних залізобетонних елементів за деформаційною моделлю / А. Я. Барашиков, І. В. Задорожнікова // Ресурсоекономні матеріали, конструкції будівлі і споруди. Зб. наук статей - Рівне: НУВГП. – 2005. - № 12. - С. 109 - 115.
165. Барашиков А. Я. Методика розрахунку залізобетонних конструкцій за деформативною моделлю згідно з проектом нових норм України/ А. Я. Барашиков // Сучасне промислове та цивільне будівництво. – 2005. - №1. - С.13-18.
166. Барашиков А. Я. Надежность зданий и сооружений / А. Я. Барашиков, М. Д. Сирота - К.: УМК ВО, 1993. - 212 с.
167. Барашиков А. Я. Оценка технического состо-яния строительных конструкций зданий и сору-жений / А. Я. Барашиков - К.: НМЦ Держнагляд-охоронпраці України, 1998. - 232 с.
168. Барашиков А. Я. Оцінювання технічного стану будівель та інженерних споруд: навч. посіб. / А. Я. Барашиков, О.М. Малишев - К.:Основа, 2008. - 320с.
169. Мальганов А. И. Восстановление и усиление строительных конструкций аварийных и реконструируемых зданий: атлас схем и чертежей / А. И. Мальганов, В. С. Плевков, А. И. Полищук - Томск: Том. ун-т., 1990. - 456 с.
170.Оцінка технічного стану сталевих конструкцій виробничих будівель і споруд, що знаходяться в експлуатації: ДБН 362-92.- К.: Держбуд України, 1992. - 45 с.
171.Система забезпечення надійності та безпеки бу-дівельних об'єктів. Положення про розслідування причин аварій (обрушень) будівель, споруд, їх час-тин та конструктивних елементов: ДБН В.1.2-1-95. – К.:Держкоммістобудування України. 1995. - 23 с.
172. Будинки та споруди на підроблюваних терито-ріях і просідаючих грунтах. Ч.II. Будинки та споруди на просідаючих грунтах: ДБН В.1.1-5-2000 - [Чинний від 01.07.00]. - К.: Держкомітет будівництва, архітектури та житлової політики України, 2000. - 87 с.
173. Пожежна безпека об'єктів будівництва: ДБН В.1.1-7-2002 - [Чинний від 2003-05-01]. - Мінбуд

України - К.: Держбуд України, 2002. - 87 с.
174. Будівлі та споруди. Житлові будівлі. Основні положення: ДБН В.2.2-15-2005 – К.: Державний комітет України по будівництву та архітектурі, 2005.
175. Система забезпечення надійності та безпеки будівельних об'єктів. Навантаження і впливи. Норми проектування: ДБН В.1.2-2:2006. - [Чинний від 01.01.2007]. – К.: Мінбуд України, 2006. - 78 с.
176. Будівництво у сейсмічних районах України: ДБНВ.1.1-12:2006. - [Чинний від 02.01.07]. - К.: Міністерство будівництва України, 2006. - 84с.
177. Система забезпечення на-дійності та безпеки будівельних об'єктів. Науково-технічний супро-від будівельних об'єктів: ДБН В.1.2-5:2007. - 2010. – 64 с.
177. Система забезпечення надійності та безпеки будівельних об'єктів. Основні вимоги до будівель і споруд. Пожежна безпека: ДБН В.1.2-7-2008 - К.: Мінрегіонбуд України, 2008. – 53 с.
178. Проектування висотних житлових і громадських будинків: ДБН В.2.2-24:2009. - К.: Мінрегіонбуд України, 2009. - 112 с.
179.Загальні принципи забезпечення надійності та конструктивної безпеки будівель, споруд, будівельних конструкцій та та основ: ДБН В.1.2-14-2009 - К.: Мінрегіонбуд України, 2009. – 45 с.
180. Захист від небезпечних геологічних умовах. Основні положення проектування: ДБН В.1.1-24-2009 - К.: Мінрегіонбуд України, 2010. – 73 с
181. Actions on structures: Eurocode-1 - Part 1-7: General actions - Accidental actions. EN 1991.1.7 - 2006.
182. Design of Concrete Structures: Eurocode-2. – Part 1-3: General Pules and Pules for Buildings, Comnission of the European Communities ENV. 1992. 1.1 - 1991 - 253 p.
183. Basic of Design and Actions on Structures. European Commit tee for Standardization: ENV1991-1:1994 - Brussel, 1994. - 85 p.
184. Design of Steel Structures. CEN European Committee for Standardization: ENV 1991-1-1:1994 - Brussel, 1994. - 85 p.
185. Дії на конструкції. Частина 1-3. Загальні дії. Снігові навантаження. (EN 1991-1-3:2003, IDT): ДСТУ-НБЕN1991-1-3:2010. Єврокод 1. – К.: Мінрегіонбуд України, 2010. – 53 с.
186. Бетонні та залізобетонні конструкції з важкого бетону. Правила проектування: ДСТУ Б.В.2.6-156:2010. - [Чин. від 2011-06-01]. -К.: Мінрегіонбуд України, 2011. - 118 с.
187. Палі. Визначення несучої здатності за результатами випробувань: ДСТУ Б В.2.1-27:2010. -К.: Мінрегіонбуд України, 2010. - 68 с.
188. Геотехнічне проектування: ДСТУ-Н Б EN-1997-1:2011 (Єврокод-7). – К.: Мінрегіонбуд України, 2011. - 48 с.
189. Жилые здания: МГСН3.01-01. - [Введен в действие с 02.10.2001]. - М.: 2001. - 73 с.
190. Правила обстежень, оцінки технічного стану та паспортизації виробничих будівель і споруд: НПАОП 45.2-1.01-98 – К.: Мінрегіонбуд України, 1998. - 21 с.
191. Положення про безпечну та надійну експлуатацію виробничих будівель і споруд: НПАОП 45.2-4.01-98 – К.: Мінрегіонбуд України, 1998. - 26 с.
192. СТАТУТ дій у надзвичайних ситуаціях. Ч.1. (Органи управління, аварійно-рятувальні підрозділи. Оперативно-рятувальні служби цивільного захисту). –К.: УНДІЦЗ, 2011. – 45 с.
192. Правила визначення фізичного зносу житлових будинків: СОУ ЖКГ 75.11-35077234.0015:2009. - К.: Мінрегіонбуд України, 2009. – 39 с.
193. Система забезпечення надій-ності та безпеки будівельних об'єктів. Визначення класу наслідків (відповідальності) та категорії складності обектів будівництва: проект ДСТУ-Н Б В.1.2-ХХ:201Х – К.: Мінрегіон України, 2010. - 38 с.
194. Обстеження і оцінка технічного стану будівель та споруд. Організація і виконання робіт. Асоціації незалежних експертів України: СТТУ БС 01-03 – К.: УКРЕКСПЕРТ, 2003. – 70 с.
195. Требования к проведению оценки безопасности эксплуатации производственных зданий и соружений поднадзорных промышленных производств и объектов: РД.22-01.97. - К.: Мінрегіонбуд України, 1997. – 42 с.

Навчальне видання

БАРАШИКОВ Арнольд Якович
ЛАПЕНКО Олександр Іванович
ПЕРШАКОВ Валерій Миколайович
БЄЛЯТИНСЬКИЙ Андрій Олександрович
БІЛОКУРОВ Павло Сергійович

ПІДСИЛЕННЯ ЗАЛІЗОБЕТОННИХ ТА КАМЯНИХ ЕЛЕМЕНТІВ У СПОРУДАХ, ЩО ПІДЛЯГАЮТЬ РЕКОНСТРУКЦІЇ

Наочний посібник

(Англійською мовою)

В авторській редакції

Технічний редактор *А. І. Лавринович*

Підп. до друку 03.02.2016. Формат 60x84/8. Папір офс.
Офс. друк. Ум. друк. арк. 14,88. Обл.-вид. арк. 16,0.
Тираж 100 пр. Замовлення № 8-1.

Видавець і виготівник
Національний авіаційний університет
03680. Київ-58, проспект Космонавта Комарова, 1.

Свідоцтво про внесення до Державного реєстру ДК № 977 від 05.07.2002